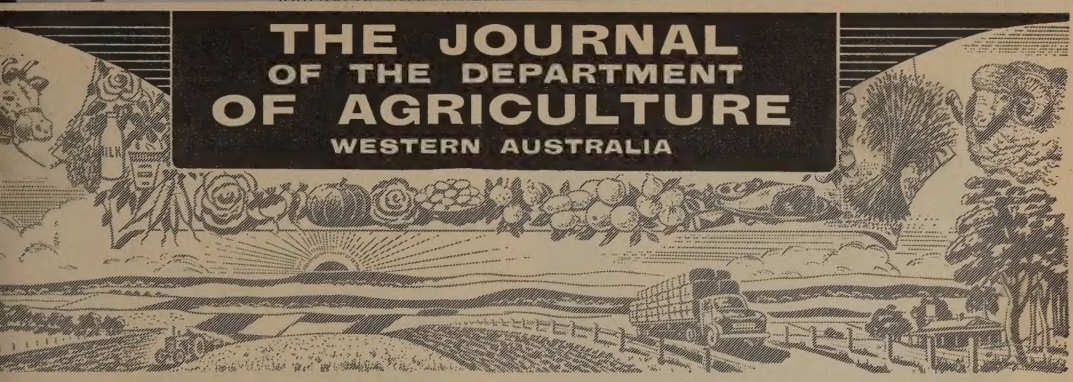
THE JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA



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Edited by
J. A. MALLETT

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COVER PICTURE
Picking table grapes on a vineyard in the Swan River valley

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SAFFLOWER

An Oil Crop

FOR THE KIMBERLEYS

Fig. 1.—Safflower growing at the Kimberley Research Station

By D. F. BEECH*

EXPERIMENTS with irrigated safflower carried out at the Kimberley Research Station have shown that the crop is well adapted to the local conditions. In recent years yields of 2,000 to 3,000 lb. per acre have been generally obtained. Oil content of the main variety under trial varied between 33 and 35 per cent. Locally produced safflower oil could help to make the Australian paint industry largely independent of imports. Safflower meal is a protein-rich concentrate and could have considerable impact on the Kimberley cattle industry. Safflower is likely to play an important part in the early development of irrigation agriculture on the Ord plains.

Although a recent introduction to this country, safflower has been grown as an oil seed crop in the Middle East and India since ancient times. During the last decade the crop has attracted considerable attention from American farmers. In Australia experimental work on safflower has been carried out since the end of World War II, mainly by the C.S.I.R.O. at the Waite Agricultural Research Institute.

At the Kimberley Research Station the trials with safflower commenced in 1951, and during the last three years this work has been considerably intensified. The results are most promising and there is little doubt that safflower will play a leading part in the imminent development of irrigation agriculture on the Ord River plains.

Safflower (*Carthamus tinctorius,* L.) belongs to the Compositae family. It is an erect thistle-like plant growing from 2 to 5 ft. high. Some varieties are very spiny while others are almost spineless. The flowers are white, yellow or orange depending on the variety. The white oil-bearing seeds are similar in size to those of the sunflower. The plant develops a vigorous tap root often penetrating to the depth of 6 to 7 ft. and consequently is comparatively drought-resistant. While safflower is closely related to the thistles, it is very unlikely to become a weed since its seeds do not remain dormant in the soil.

* The author is an officer of the Division of Land Research and Regional Survey, C.S.I.R.O., working at the Kimberley Research Station operated jointly by the Western Australian Government and the C.S.I.R.O.

LAND PREPARATION AND PLANTING

The seedbed preparation is similar to that used in wheat farming. At Kimberley Research Station where safflower is grown under irrigation, a border-check irrigation system, which permits the use of an ordinary seed-drill, has been found preferable to furrow irrigation. With the latter system where the crop is planted in rows, weed control in inter-row spaces requires additional cultivation. Moreover, if the high seeding rates desirable for high yields are used, the crop grown in widely spaced rows is liable to lodge. Careful land levelling is however essential with the flood irrigation in order to prevent irregular watering. With proper equipment and sufficient experience it can be carried out fairly rapidly.

The experiments at Kimberley Research Station have shown that under local climatic conditions safflower must be grown as a dry winter season crop. It has been found that, in order to obtain best yields, safflower should be planted between early April and late May. Earlier planting is impracticable because the soil is too wet for cultivation after the rains. Later planting results in considerably reduced yields. The importance of timely planting is shown by the results of a time of planting experiment given in Table 1.

The rate of sowing and spacing are of considerable importance in the establishment, early growth and in determining the suitability of safflower for mechanical harvesting. It has been found that high sowing rates lead to better seedling emergence, especially where soil crusting occurs. High plant density is also desirable because it enables the crop to compete better with weeds, particularly since it reduces the duration of the rosette stage when weed competition is most serious.

With a low plant stand, the number of heads per plant is increased. This leads to delays in harvesting because the period of flowering and maturation is extended. A deeper cut with the header is necessary to gather all heads, thus slowing harvesting operations. To avoid the risk of rain, it is often necessary to harvest before the younger heads are completely mature and this results in reduced yields and lower oil contents. The oil content of seed from the later-maturing heads is invariably lower, consequently the oil yield of a crop containing a considerable proportion of such heads is obviously inferior. It is therefore desirable to keep the number of heads on individual plants down to four, while maintaining a high number of heads per acre. This can be achieved with a high plant density.

The experimental work at the Kimberley Research Station has shown that the most suitable plant population can be obtained with sowing rate of 60 lb. to 80 lb. per acre and row spacing of 7 in., a normal row width of grain drill.

Shallow seeding at about ½ in. depth appears to be desirable to obtain good stands.

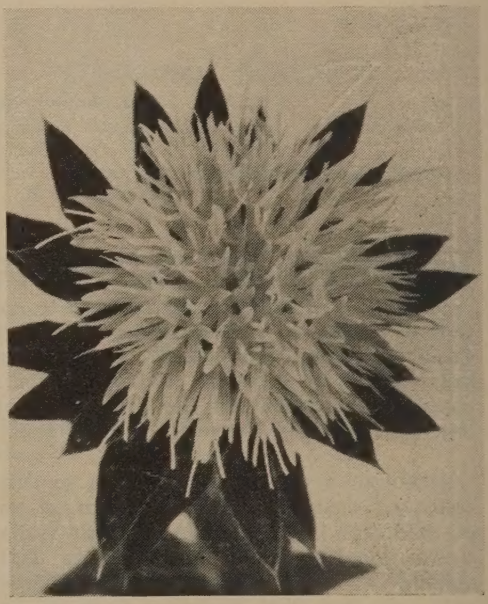


Fig. 2.—Blossom of safflower

FERTILISER REQUIREMENTS

To date, comparatively little work has been done on fertiliser requirement of safflower grown on local heavy clay soils. The preliminary trials indicate that both phosphatic and nitrogenous fertilisers are necessary. On virgin land up to 3 cwt. per acre of superphosphate may be needed while on land previously "supered," 1 cwt. per acre may be sufficient. In all cases 1 cwt. per acre of sulphate of ammonia is

required. In trials conducted to date application of higher rates of superphosphate and sulphate of ammonia had no significant effect on either grain or oil yield. Application of potassium fertiliser failed to produce any significant response in grain or oil yield of safflower.

Further work is still necessary to determine more precisely the fertiliser requirements of this crop and to find out whether fertiliser placement has any effect.

IRRIGATION REQUIREMENTS

Under Kimberley conditions, safflower is grown during the dry season entirely under irrigation.

In order to obtain a clean seed-bed with suitable tilth, pre-irrigation is generally necessary. After the crop is sown it receives its first irrigation as soon as possible and subsequently it is watered at approximately 10-day intervals until about four weeks after the commencement of flowering. Experience at the Station indicates that the maximum water requirements for crops planted in May occur during the flowering period in early September. Water stress at this time can have considerable effect on yield.

The total quantity of irrigation water required for the crop is about 2½ acre feet.

PLANT GROWTH AND DEVELOPMENT

With Variety 4 (1), at present regarded as a standard variety for the region, three to five days elapse between the first irrigation and seedling emergence depending upon temperatures and depth of seeding. The rosette stage, which follows, lasts approximately three weeks. During this stage growth is slow but the plant forms its vegetative structure. Approximately four weeks after emergence the plant has its full complement of leaves, including the embryonic ones, and the first four to five rudimentary inflorescences. At the end of the third week rapid elongation commences and continues until the appearance of the first flower approximately six weeks later.

Oil formation begins almost immediately after fertilisation, and four weeks after commencement of flowering the oil content reaches its maximum. The iodine value of oil—a measure of oil quality—also changes rapidly, increasing to a maximum about five weeks after commencement of flowering. The increase in seed weight is a gradual process, showing a steady rise up to six weeks after commencement of flowering.

HARVESTING

The mature safflower crop can be easily harvested mechanically using an ordinary grain header. While it is necessary to reduce the speed of the threshing drum and adjust the clearance between drum and concave, the settings of the other parts are the same as those generally used for cereals. Because of thickness of the safflower stems it is necessary to remove some of the fingers of the comb, thus increasing their spacing.

The crop is ready to harvest when the bracts, that is the leaf-like structures enclosing the seed, are dry. It is desirable to harvest the crop while stems are still partially green. This gives a cleaner sample than with crop harvested later. Depending on time of planting and variety, the period from sowing to harvest is approximately 140 days.

YIELDS AND OIL CONTENT

The yields at Kimberley Research Station varied from 500 lb. to over 3,000 lb. per acre. In recent years with increased farming experience of this crop, and particularly the proper appreciation of the importance of time of planting and heavier sowing rates, the yields were generally between 2,000 lb. and 3,000 lb. per acre.

The oil content varies between 25 per cent, and 40 per cent. depending on variety and time of planting. With Variety 4 (1) planted in May the oil content is usually between 33 per cent. and 35 per cent.

VARIETIES

Some 30 varieties of safflower have been tried at Kimberley Research Station. With one exception, all varieties currently under trial at the Station have been developed at the Waite Agricultural Research Institute from the material originally imported from the Middle East and India. The varieties which have proved most suitable under Kimberley conditions are mainly derived from the Egyptian material.

As a result of variety trials, Variety 4 (1) was chosen for more intensive agronomic

investigations, and would at present be recommended for commercial cultivation. However, some other varieties are being maintained as a possible source of useful characteristics for future characteristics for future breeding programmes. For example, Variety 55 (1) has a very short rosette stage, which enables the plant to compete better with weeds in the early growth stages. Several other varieties have a higher oil content, while others may be useful because of their low iodine number. Variety 803 (20) is entirely spineless and possesses particularly large seed, which may be easier to decorticate.

Currently the seed stocks of 18 varieties are maintained at the Station.

Fig. 3.—Safflower plant showing growth habit

PESTS AND DISEASES

The damage caused by insect pests under Kimberley conditions can be considerable if protective spraying is not employed. For example, in 1959, an unsprayed plot yielded 600 lb. per acre less than a sprayed plot. Larvae of *Prodenia litura* and *Heliothis armigera* are mainly responsible. The first species feeds on foliage while *Heliothis* damages the fruiting points of the plants. Endrin and DDT sprayed at regular intervals have been effective in controlling insects but further work has to be done to reduce control measures to a minimum.

No diseases of importance were noted at the Station.

CONCLUSIONS

Safflower oil properties fall between those of linseed and soyabean oils. The oil is mainly used in paint manufacture, and to a lesser extent as a linseed oil substitute by the floor covering industry. Because of its low linolenic glyceride content, paints and enamels made from safflower oil show outstanding non-yellowing properties. The oil is particularly suitable for manufacture of alkyd resins which are replacing oil and other resins in enamels.

At present only a small proportion of safflower oil is used for human consumption. However, it has been claimed that because of its high content of unsaturated glycerides, the inclusion of safflower oil in the diet may be of value in maintaining low cholestrol levels in the blood, and consequently reducing the danger of coronary and arterial diseases. If this claim is substantiated a considerable increase in demand for the oil could be anticipated.

The safflower meal or cake left over after the oil is extracted is a valuable livestock feed. The meal made from undecorticated (unhusked) seed contains about 18 per cent. protein. The protein content of decorticated meal is of the order of 35-40 per cent. If safflower cultivation develops in the Kimberleys the impact of locally produced protein-rich concentrate on the local cattle industry may be very considerable.

During the last decade the production of safflower has been rapidly increasing in the U.S.A., mainly in California. Estimated production in 1958 amounted to nearly 150 million lb. In Australia safflower has been tried at several centres, with promising results. However the crop is still only in an experimental stage commercially. Growing safflower in this

country would help to make its paint industry independent of overseas supplies. Conditions of the Kimberley region have been shown to be well suited to production of the crop under irrigation and safflower is likely to be one of the main crops in the early development of the Ord scheme.

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Dr. E. Phillips and colleagues at the Kimberley Research Station for their help and active interest in this work, and to Mr. J. J. Basinski for his help in preparation of this paper.

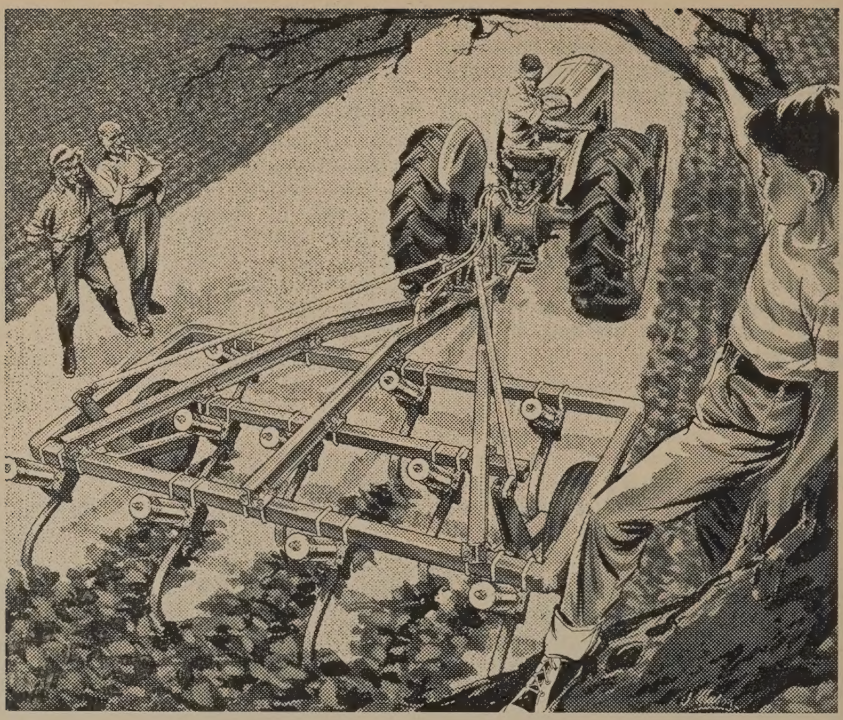
TABLE 1.

The effect of time of planting on seed and oil yield of safflower at the Kimberley Research Station.

Date of Planting	Seed Yield	Oil Content	Oil Yield
1957	lb/acre	%	lb./acre
May 2	1,974	28	550
May 16	1,983	28	555
May 30	1,435	30	430
June 13	1,105	30	330
June 27	897	30	270
July 11	812	29	235
July 25	734	27	200
August 9	250	20	50
August 23	52	13	5

Lack of Water-Points Caused this Erosion

Provide water in every paddock; if you don't you can't graze your land efficiently. Watered paddocks become overgrazed and those unwatered become undergrazed. Money is lost in each case, and stock travelling to water, through gates cause erosion. Here is a typical example.



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SHEARING SHED Design

By W. L. McGARRY, Officer in Charge, Sheep and Wool Section; D. A. YOUNG, Shearing Instructor; and M. BUTLER, Sheep and Wool Instructor

PLANNING the layout of a shearing shed requires a good deal of thought to ensure its maximum working efficiency. If the contemplated structure is to serve the dual purpose of storage-shearing shed, it is better to plan a shearing shed that can be used for storage, rather than a storage shed with a view to its utilisation as a shearing shed.

The size of the shed to be constructed should be governed by the number of sheep the shed will be required to accommodate when property development is fully completed, and the number of shearing stands it will be necessary to install, together with the provision of a well lighted woolroom sufficiently large to allow the wool to be handled and classed in a quick and efficient manner. In deciding the machinery requirements, it would be reasonable to estimate on the basis of output of 120 sheep per shearing stand per day.

There are several types of shearing shed in common use, but the raised type of shed has definite labour-saving advantages. Some of the advantages of an elevated shed with a centrally situated shearing board are:—

(1) The wool flows freely in one direction, promoting efficiency and saving time in handling.

(2) The shearer does not have to step over the shorn fleece, nor drag sheep across the shearing board.

(3) The fleece can be picked up, and thrown on to the wool table with the minimum of time and effort.

(4) Unshorn sheep can be housed under the shed during periods of inclement weather.

(5) Freshly shorn sheep are provided with some protection from the heat, or from cold winds and rain while held in the counting out pens.

(6) With the provision of a loading-out door, sheep can be held in the shed and loaded direct on to truck for transport.

(7) Bought sheep can be unloaded into the shed for examination, classing, etc., if desired.

(8) The loading out of wool, and the handling in or out of grain, super, etc., are greatly facilitated.

(9) Provision of storage space, out of the weather, under the shed for the stacking of sawn timber, piping, or other materials.

In addition, the elevated type of shearing shed is much more hygienic than sheds built at ground level. It is easier to keep clean, and can lessen the risk of spread of disease and infection.

Recommended plans for both two-stand and four-stand elevated type shearing sheds, with fixed overhead machinery are illustrated (Figs. 1 to 3).

TYPE OF MACHINERY

Fixed overhead shearing gear is much more efficient than portable plants and with reasonable care and attention will give many years of satisfactory service. This type of shearing machinery is more satisfactory to the shearer, directly assisting him to achieve a better standard of

workmanship and higher tallies of shorn sheep. Shearers, generally are reluctant to accept work where portable plants are used, and often difficulty is experienced in engaging suitable shearing labour.

UPRIGHT POSTS SUPPORTING THE MACHINERY

The upright posts supporting the shearing machinery should be 8 in. x 8 in. milled timber. These must be set three to four

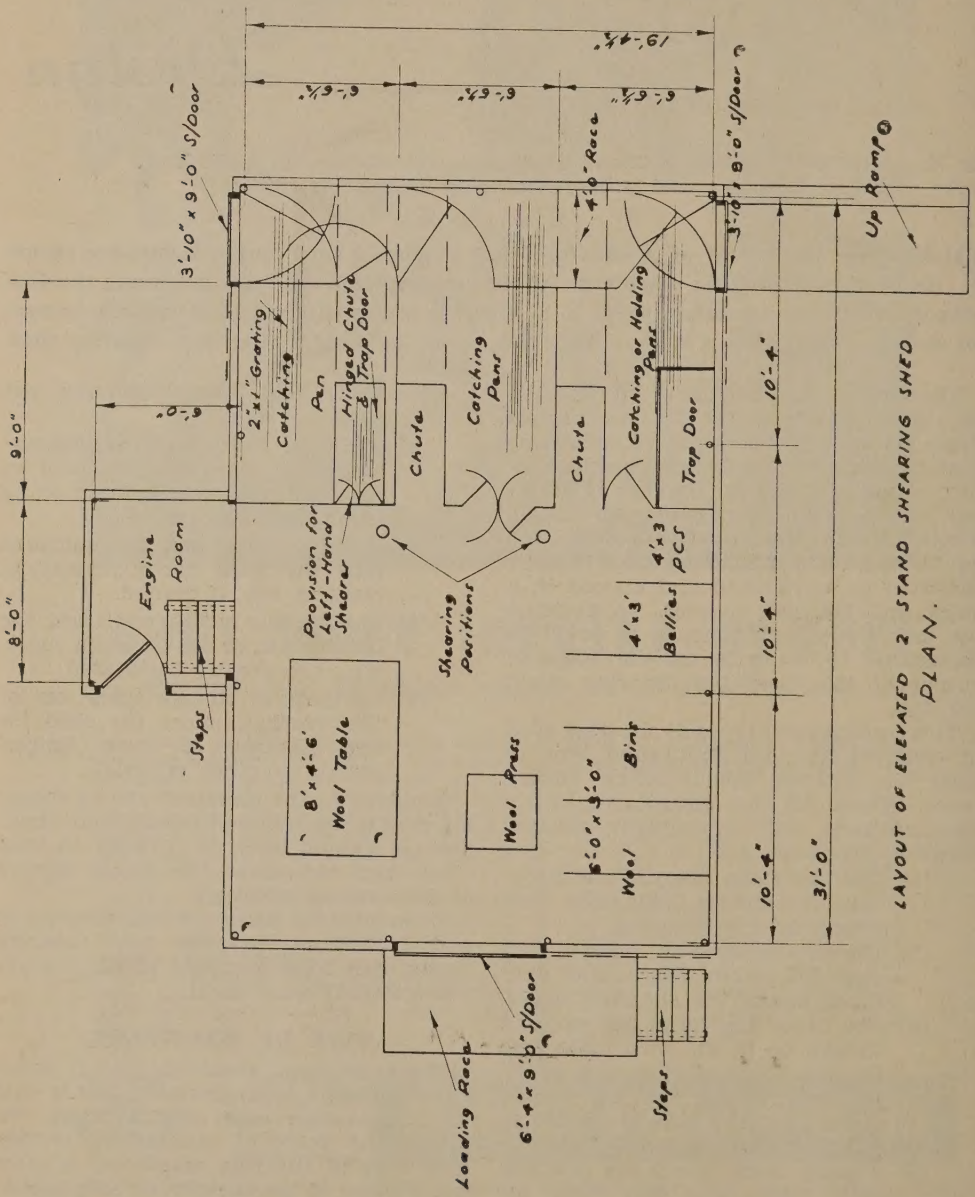
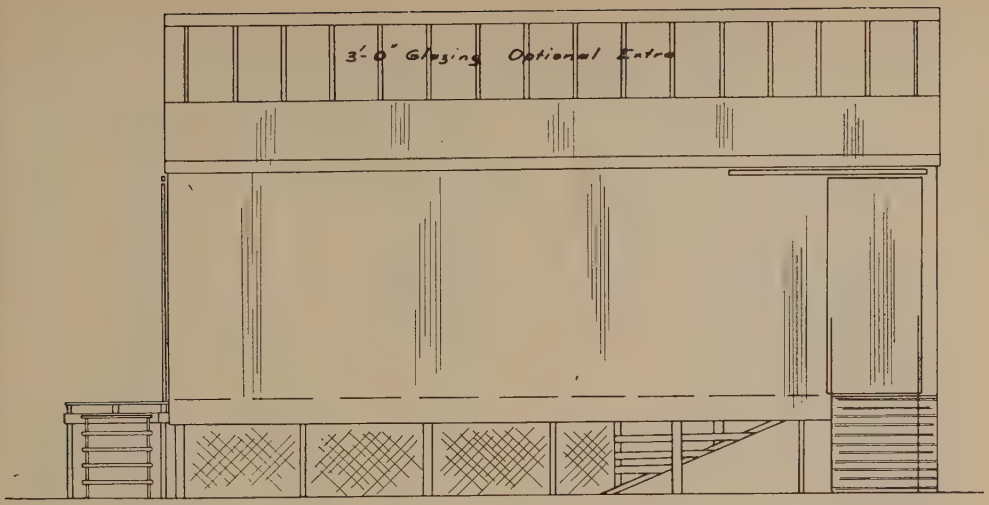
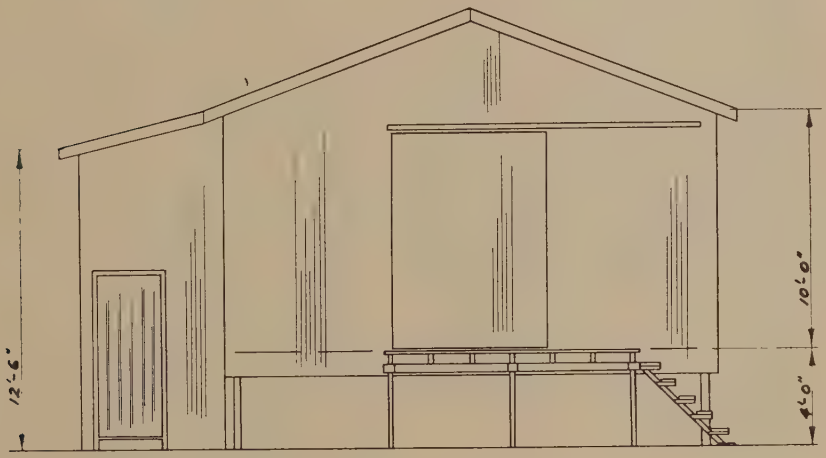


Fig. 1.—Plan of elevated 2-stand shearing shed



ELEVATION.



FRONT END VIEW OF
END ELEVATION.

Fig. 2.—Front and end elevation of shed shown in Fig. 1

feet in the ground, preferably in concrete, for rigidity. As the uprights must reach approximately 8 ft. 4 in. above the level of the floor, allowance must be made for the distance between the ground and floor level.

Steel uprights, made especially for the purpose of carrying shearing machinery are obtainable. These are recommended, as they are longer lasting, more rigid, and completely free of vibration. Advice on the use of uprights is available from suppliers of shearing equipment.

INSTALLING THE SHEARING PLANT

Special care should be taken when installing the shearing plant to make sure

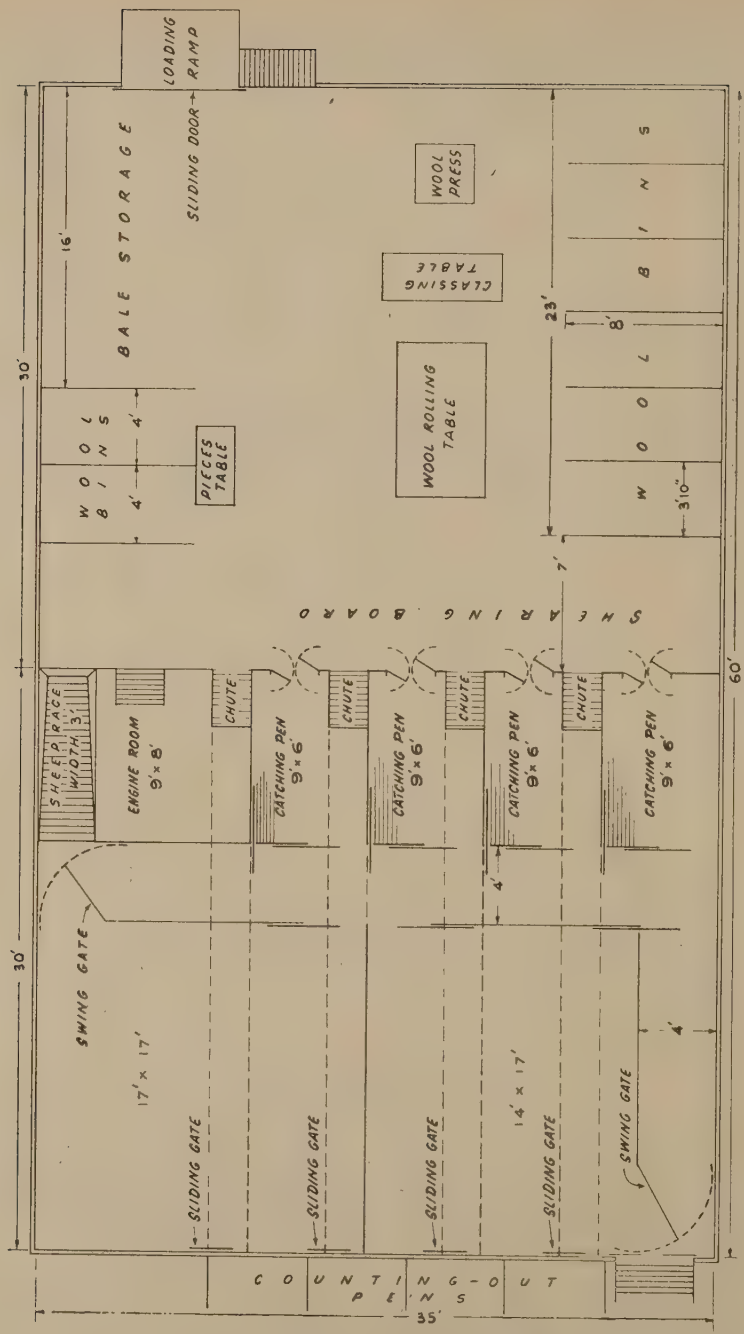


Fig. 3.—Plan of 4-stand shearing shed

that the shafting is placed at the correct height from the level of the floor. This is most important, as any slight variation in height will reduce the efficiency of the whole unit by restricting the reach of the down tubes and forcing the shearer to work out of position.

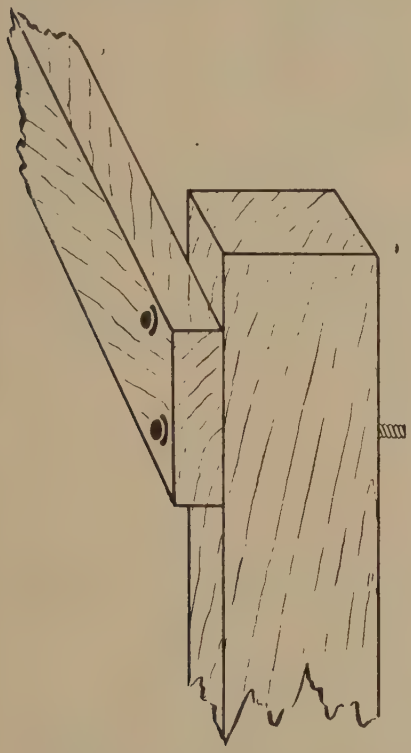


Fig. 4.—The beam carrying the machinery brackets should not be recessed into the uprights

The correct height of shafting varies with type of plant and advice may be obtained from the distributor.

A 10 in. x 4 in. timber beam of sufficient length is supplied for mounting the brackets carrying the machinery.

This beam should be bolted directly on to, and not recessed into the uprights (Fig. 4). This is necessary to place the down tubes the requisite distance out from the wall, which should not be less than 14 in. (Fig. 5). If the beam is recessed into the uprights, as frequently happens, this distance is lessened and the universal joint of the down tube constantly comes into contact with the wall of the shed which makes for lowered efficiency and bad shearing. A major and common fault in erecting the machinery is in having the down tube too close to the wall.

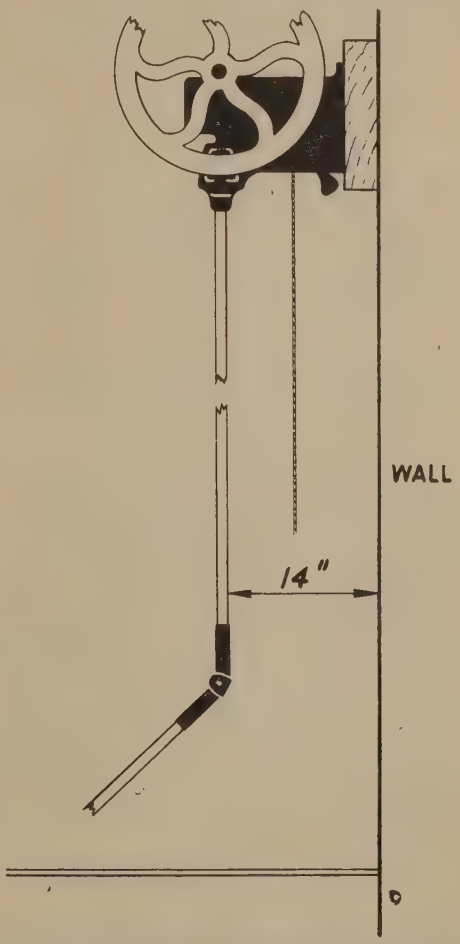


Fig. 5.—Allow at least 14 in. between down-tube and wall

SPACING OF THE SHEARING STANDS

The space allowed between the shearing stands should not be less than 5 ft. 6 in. and preferably 6 ft. which gives a greater margin of safety.

Where shearing stands are insufficiently spaced, they hamper the shearer who is always conscious of the possibility of injury should his own or the next machine

become out of control. Because of this, his attention is divided between his own and the next machine to the detriment of the work.

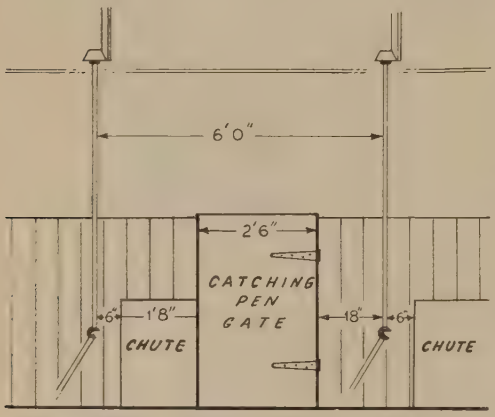


Fig. 6.—Diagram showing position of chutes and catching-pen gate

THE SHEARING BOARD

The provision of adequate room on the shearing board is most essential, as a good standard of workmanship cannot be achieved under cramped conditions.

Shearing costs are to a large extent governed by the efficiency and dispatch with which the sheep are shorn, and any faults in shed construction that retard the shearers are reflected in increased costs of shearing operations.

With centrally situated shearing boards, a minimum width of 7 ft. will suffice. Where the shearing board is located on the side wall of the shed with the chutes leading out into open pens, the shearing board should be a least 8 ft. Narrower boards do not allow sufficient room for the shearing of grown sheep and lead to congestion, while over-wide boards can increase the work and reduce the tallies of the shearer through extra and unnecessary distance from catching pen to shearing stand.

CATCHING PEN GATE AND CHUTE

The position of the gate in relation to the let-go chute is shown in Fig. 6. In the elevated type of shearing shed the catching pen is situated behind the shearing stand, with the gate opening approximately 1 ft. 6 in. to the right of the down tube. This enables the shearer to catch his sheep and then move backward to the shearing board without having to cover too much ground or make unnecessary turns. It also obviates the necessity of having to step over the shorn fleece, leaving it free to be picked up and thrown onto the wool table with a minimum of effort.

The letting-go chute should be situated so that the near side of the chute is 6 in. to the left of the down tube (see illustration). In this position the chute will be immediately behind the shearer finishing and provides easy exit for the shorn sheep.

ANGLE OF CHUTE FLOOR

The let-go chutes should be erected at an angle of about 45° with the floor (see Fig. 7). This will allow the shorn sheep to slide gently to ground level as it leaves the shearer.

Where sheep are allowed to drop directly from the floor level onto the ground, there is always the risk of the animal being injured.

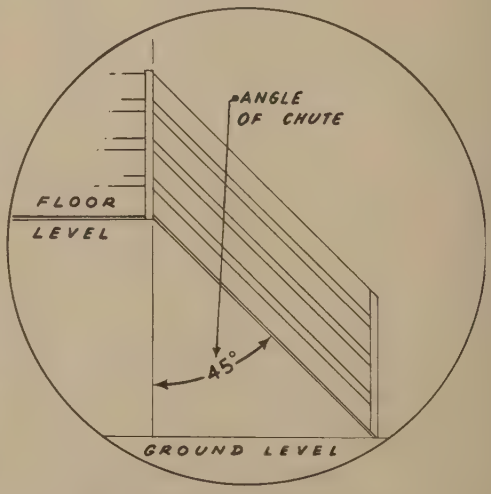


Fig. 7.—Showing angle of let-go chute

GRATINGS

Grating floors are essential where sheep are held for any length of time such as the catching and holding pens, in order to prevent the accumulation of droppings from fouling the floor. Timber for grating is supplied with chamfered sides,

(see Fig. 12), which also shows the method of laying the grating with the chamfered sides downward.

This prevents the possibility of droppings becoming lodged between the gratings and building up. The direction the grating is laid is illustrated in the plans

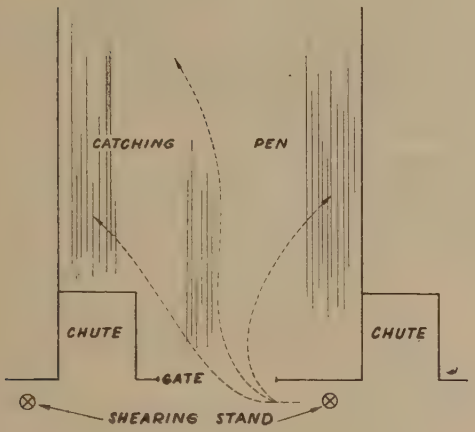


Fig. 8.—Showing recommended position of let-go chute for the preceding stand

of shearing sheds (Figs. 1 to 3). They should be placed across the line of travel of the sheep, excepting in the catching pen.

In the catching pens it is recommended that the grating be laid parallel with the direction the shearer drags his sheep when taking it to the shearing board, in order to avoid the possibility of the sheep's feet being caught between the gratings and causing injury.

THE CATCHING PENS

The catching pens should be big enough to accommodate enough sheep for at least one hour's shearing, in order to avoid the necessity of frequent fillings.

The width of the catching pens will be governed by the width the shearing stands are spaced, but the length should not exceed 10 ft. Any greater distance than 10 ft. has no advantage, but will entail extra work in fetching sheep on to the board.

It is a distinct advantage, when penning up sheep, if the front of the catching pen is close-boarded to a height that prevents the sheep from seeing any activity taking place on the shearing board.

CATCHING PEN LAYOUT

In laying out the catching pens, it is an advantage to place the letting-go chute for

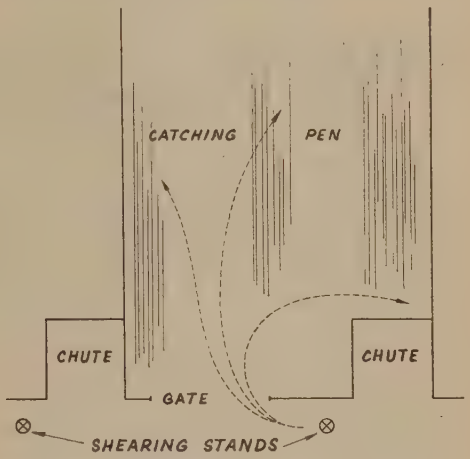


Fig. 9.—When let-go chute is situated as shown, the sheep tend to crowd on the chute

the preceding stand in the adjacent catching pen, as illustrated (Fig. 8). The advantage of this layout, which makes catching easier, is that sheep tend to crowd **away** from the chute and towards the back of the pen when the chute is on the left side of shearer going in and out of pen. Conversely sheep tend to crowd **towards** the chute when it is placed on right hand side of shearer entering pen. (Fig. 9.)

With the chute on the left, the shearer has a straight pull from any point in the catching pen, and there is less chance of his tripping, or bumping into the chute when bringing sheep on to the shearing board.

A TIME SAVING DEVICE

Valuable shearing time is frequently lost with "cut outs" when changing from one flock to another.

This can be minimised by incorporating a drop gate, (Fig. 10) in the let-go pen. This gate can be closed behind the shorn sheep at the completion of one flock, and allow the commencement of shearing on

the other flock without the necessity of waiting for the shorn sheep to be counted.

The shorn sheep may then be counted out without undue haste and at a more convenient time.

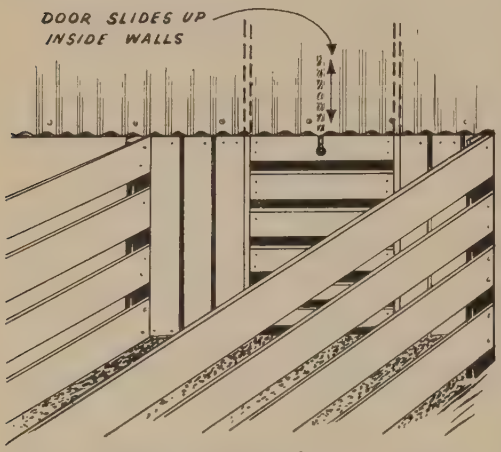


Fig. 10.—Drop gate in let-go pen

TRANSFERRING SHEEP INTO SHED FROM UNDERNEATH

Where sheep are accommodated underneath the wool room during wet weather, these can be transferred to the holding pens without the necessity of taking them outside the shed. With the provision of a trapdoor and sloping race as illustrated, (Fig. 11), sheep may be driven directly into the holding pens in the shed.

LEFT-HANDED SHEARER

Quite often a shearer is engaged who is left-handed, and this sometimes presents a problem as all shearing stands are erected for the use of right-handed shearers. This may be overcome by the substitution of a hinged trapdoor in the gateway of the number one catching pen, which, when raised will form a let-go chute for a left-handed shearer who then catches from the number two catching pen. See plan of two-stand shed, (Fig. 1).

HOUSING THE ENGINE AND GRINDING MACHINERY

It is always preferable to house the engine and grinding plant in a separate room attached to the shed, firstly to eliminate exhaust fumes and noise and, secondly, for safety when the grinding is being carried out. It also provides a suitable place for the workbench, a necessity in all shearing sheds, and for the storage of the down-tubes, tools, emery, etc., where they can be locked away at the completion of shearing.

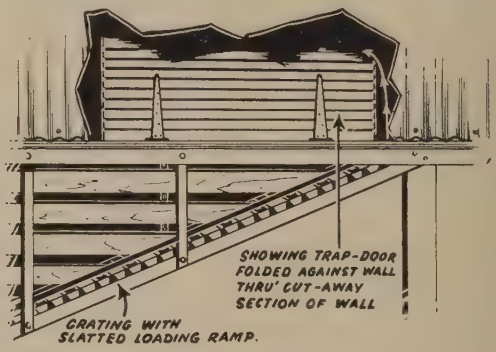


Fig. 11.—Trapdoor and race for entry of sheep from beneath the shed

THE WOOL ROOM

The following requirements are esssential:—

(1) Adequate space and a good natural light.
(2) Sufficient wool bins in relation to the size of clip.
(3) Suitable wool rolling table—size 10 ft. x 5 ft.
(4) Classing and piece-picking tables.
(5) Wool press and scales.
(6) Straw brooms and baskets.

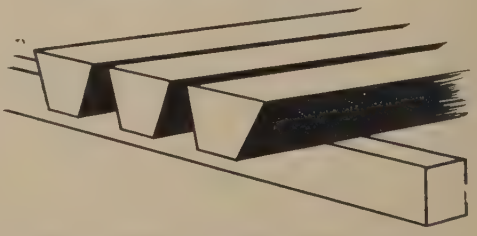


Fig. 12.—Method of laying chamfered grating

Portable bins made of light timber in the form of frames with the uprights fitting into "feet" are recommended.

These can be moved and placed anywhere in the shed during and after shearing. They permit a better light penetration to each bin and can be easily and quickly adapted to any size to accommodate the quantity of wool going into various lines.

● *From an A.B.C. Country Hour broadcast given by C. R. TOOP B.V.Sc. Chief Veterinary Surgeon*

BRUCELLOSIS AND ITS CONTROL WITH STRAIN 19 VACCINE

DAIRY farmers of a generation ago will not need to be reminded of the ravages of contagious abortion or of the need for the continued application of effective control measures. Fifteen or 20 years ago this disease which we now call Brucellosis was rife throughout the dairying districts of the State and it exacted a heavy toll. The "abortion storm" was a common occurrence and it was not unusual for 30 per cent., and sometimes considerably more, of the cows in a herd to lose their calves at about the sixth month of pregnancy.

This resulted in a heavy loss of milk production and it was a most serious matter not only to farmers in the butterfat areas who desired to take full advantage of the flush season but also to the wholemilk producer who had set his herd for summer calvings in order to maintain his "quota."

HUMAN HEALTH

In addition to the loss of calves and greatly reduced production there was usually an infertility problem and a period of many months often elapsed before affected cows would again hold to service. The risk to human health had also to be considered since the infection of cattle is transmissible to man, producing the disease known as undulant fever which may become chronic and is often incurable. In quite a large proportion of affected cows the infection becomes localised in the udder and many human cases have been traced to the consumption of infected milk. In veterinary surgeons, dairy farmers and meat workers, undulant fever is regarded as an occupational hazard associated with the handling of infected cattle or their products and they are more liable to infection than other sections of the community.

THE DISEASE DESCRIBED

Brucellosis is caused by the microbe *Brucella abortus* and the infection is spread by the consumption of pastures contaminated by the discharges shed by infected cows for several weeks after abortion and often after normal calving, as well as by aborted foetuses and their membranes. There are other modes of transmission such as through wounds or abrasions on the skin or through the eye membranes by the agency of flies but these are of little practical importance and it may also be worth noting that the bull plays little if any part in the spread of the infection.

When a pregnant animal is exposed to infection, the organisms invade the developing foetus and the placental membranes in which it is contained; the uterus becomes inflamed and the foetus dies and is expelled resulting in abortion usually between the fifth and seventh months of gestation.

In the "empty" female the infection may not become established or persist for very long and the animal suffers no ill effects.

When brucellosis is first introduced into a susceptible herd it frequently runs an acute course during which a large number of abortions may occur in rapid succes-

sion but after a season or two—as the result of the development of a resistance or immunity from exposure to field infections—it gradually subsides and a stage is reached where few abortions occur and these are largely confined to heifers and young cows which have not been previously exposed. To this extent the disease is self-limiting.

CONTROL WAS DIFFICULT

Before the advent of Strain 19 vaccine, no practical means of control was available. Hygienic precautions which involved the destruction of aborted calves and their membranes and the isolation of cows until all discharges had ceased, were advocated but under the conditions of management on the average dairy farm, these precautions could not be applied rigidly enough and they usually ended in failure.

It is possible to eradicate the disease by the test-and-slaughter method. Blood samples are collected from every member of the herd and subjected to a diagnostic test and testing repeated at frequent intervals until every positive reactor has been eliminated by slaughter. This is a costly approach to the problem, particularly in herds where the incidence is high. Furthermore, it would result in the establishment of highly susceptible herds and should infection be re-introduced (which with the disease still prevalent in the cattle population would not be unlikely), the consequences could be most serious.

Complete eradication both on an area and State-wide basis which has been achieved or is being attempted in some other countries, must of course become the ultimate objective but this would not be feasible at the present time.

STRAIN 19

When Strain 19 vaccine became available in 1946 it became possible to launch a sustained and organised attack against the disease which embraced the immunisation of heifers throughout the dairy areas.

This product is a live vaccine prepared from a strain of *Brucella abortus* of low virulence, and while it does not produce abortion when injected into susceptible cattle, it stimulates the formation of antibodies in their tissues which enables them to resist infection if subsequently exposed to fully virulent field strains. This immunity is of quite a high order and endures throughout the life of the animal. It is not, however, absolute and could be broken down by exposure to massive infections.

A vaccination service is provided by the Department and has been available to dairy farmers at a nominal fee of 2s. per head since 1946. Approximately 75 per cent. of the heifers bred in the dairying areas are vaccinated annually as yearlings and the abortion rate has in consequence been reduced to almost negligible proportions. The associated infertility problem seems also to have been largely eliminated but the suppression of brucellosis has unmasked another and no less important cause of breeding failure in the form of vibriosis.

A WARNING

There is, however, no room for complacency. Dairy farmers of the present generation who have had no experience of brucellosis may question the need for vaccination, and others who have suffered no losses from abortion for many years may feel that it is unnecessary to continue with it as an annual routine.

It must, however, be emphasised that while Strain 19 vaccine is highly effective for the prevention of abortion, it does not necessarily prevent infection. It has been shown that whereas the abortion rate is reduced to 1/7th, the infection rate is reduced only to 1/3rd.

This means that about a third of the heifers vaccinated with Strain 19 could subsequently become infected and since these animals may excrete fully virulent *Brucella* organisms at the time of normal calving, any unvaccinated female animals grazing the same pastures would be exposed to a very serious risk of infection.

It will thus be apparent that should vaccination programes be curtailed or discontinued, the infection would steadily build up again and that within a few years we would find ourselves back in the pre-Strain 19 era with all of its attendant losses.

Dairy farmers would do well to remember that no effort has been spared in providing them with this vaccination service and that it is to their own advantage

as well as in the best interests of the dairying industry that it should continue to receive their support.

It has been the policy of the Department to provide as wide a coverage as possible and to carry out inoculations not only in the closely settled areas but also in the more remote districts no matter how small the number of heifers available for immunisation on individual properties or how far distant they may be and this service will be continued and where possible expanded in all of the dairying districts so long as the full support of local stock owners' organisations is assured.

Vaccinations for the current season are already in progress and owners with heifers for inoculation should submit an application to their District Stock Inspector either directly or through their local organisations.

Farm Tracks Deserve Attention

Why bother year after year to bump over rough eroded tracks? Road formation by contract or road board graders is surprisingly cheap. Road formation is not effective unless spur drains are formed and maintained. This was once a reasonably good track. Now it is badly eroded and resulting in waste of good land.

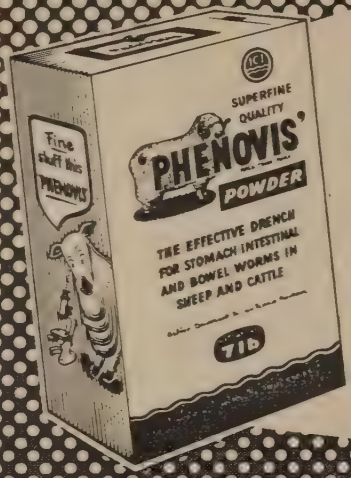
Honey Flora Calendar for April

COMPILED BY A. R. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Remarks
			Quality	Quantity		
Lustre-leaved Mallee	*Eucalyptus foecunda* Schau.	North of Dongara	Unknown	Good (one report only)	Unknown	This could be a good future honey plant.
Swamp Yate or Flat-topped Yate	*E. occidentalis* Endl.	Throughout Great Southern and along south coast	Choice	Poor to good	Unknown	Uncertain yielder, as liable to be attacked by parasites and flow is often interrupted by rain. Usually flowers every year.
Salmon Gum	*E. salmonophloia* F. Muell.	Wheat belt	Good	Poor	Poor (?)	Uncertain flow.
Mirret	*E. relastroides* Turcz.	Southern Mallee areas	Unknown	Unknown	Unknown	The activity of insects on these trees when flowering indicates they could be good honey producers.
Blackbutt	*E. patens* Benth.	South-West. Mainly in depressions or along streams. Manjimup-Bindoon	Good	Good	Good	Buds and flowers similar to Marri as far as time and sensitivity to climate. Not enough stands yet. Collie Balingup, best stands.
Powderbark Wandoo	*E. accedens* W. V. Fitzg.	Occurs on the ironstone ridges of the northern parts of the Jarrah forest	Good	Heavy to medium	Excellent	Powderbark can be differentiated from Wandoo by the powdery bark and from the fact in early winter the bark has a salmon colour. Starts to flower at the end of January and invariably sheds some mature buds just before flowering. This seems to lessen the crop of honey. Buds are held for three years, much the same as Wandoo.
Morrel	*E. olevsa* F. Muel. Var. *longicornis*	Wheat belt area	Good	Unknown, but a few reports indicate good yields	Good	A tall tree on good soil, widely scattered and difficult to find enough trees to work as a flow. Could be tried when nothing else available. No information on buds.
White Gum or Wandoo	*E. redunca* Schau. Var. *elata*. Beutla.	Winter flowering Wandoo found from Chittering north-west to Moora	Excellent	Excellent	Excellent	Tends to flower in the valleys. Major honey plant. Very little budded to flower this year.

Marri	*E. calophylla* R. Br.	Enneabba and east of Albany	Excellent	Excellent	Excellent	Major honey plant, very sensitive to climate.
Red Tingle	*E. Jacksonii* Maiden	Southern Karri forest, Denmark	Excellent	Excellent	Excellent	Not big enough stands.
Sugar Gum ..	*E. cladocalyx* F. Muell.	Not a native of W.A. but used as a street tree	Good	Heavy	Good	Since this tree is planted extensively in some towns the local beekeepers get a good crop. Buds believed to be one year old at flowering.
Hooked Mallee	*E. uncinata* Turcz.	Mallee areas. Esperance to Geraldton	Very little known in Western Australia. Victoria and South Australia regarded as excellent	Good in South Australia and Victoria	Good in South Australia and Victoria	Not worked enough in Western Australia.
Tuart	*E. gomphocephala* D.C.	Moore River-Busselton	Very good	Good	Poor (?)	Buds eaten by borers. Seldom flowers. No areas known to be budded for this year.
Menzies Banksia	*Banksia Menziesii* R.Br.	Coastal sand plain	Good	Poor to good	Unknown	Grows in association with other honey-producing plants. Keeps "brood raising" going.
Rottnest Tea Tree	*Melaleuca pubescens* Schau.	Rottnest, Cape Naturaliste, Dongara only	Poor	Good	Good	Only three stands known.
Holly-leaved Banksia	*Banksia ilicifolia* R.Br.	Low-lying areas but not swamp. In coastal plain	Unknown	Uncertain	Good	Long-flowering. No large areas.
Acorn Silver, or Orange Banksia	*B. prionotes* Lindl.	Coastal and sandplain areas	Poor	Poor to good	Good	Differing views held on this Banksia. Probably good producer in some areas. Main fault is that the tight cones trap bees.
White Heath	*Leucopogon propinquus* R.Br.	Poor sands throughout wetter portion of State, inland as far as Narrogin	Good	Good	Good	Importance of this plant is its time of flowering, producing when there is little else. Rain does not penetrate the flower and the nectar is not diluted.
Death Flower	*Calothamnus sanguineus* Labill.	Widespread, seems to like rocky slopes, either limestone or ironstone	Dark, good quality	Excellent	Good	Flowers over a long period.

It will be seen from this list that information concerning many nectar-bearing plants is far from adequate. We would appreciate further information from beekeepers.



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Mr. O. G. A. Tanner's Grand Champion English Leicester ewe at the 1959 Perth Royal Show

Famous Sheep Breeds

3.—THE LEICESTER

by

J. A. MALLETT

THE Leicester sheep, often referred to in Australia as the "English" Leicester to distinguish it from its relative, the Border Leicester, is the oldest of the improved British breeds. Its development from the nondescript local sheep marked an advance in stockbreeding technique which did much to make Britain famous as the "stud-farm of the world."

The Leicester is a breed that will always be associated with the name of Robert Bakewell of Dishley Grange Leicestershire, who has been aptly termed "the father of British studbreeding." The Leicester of the pre-Bakewell era was a lanky, slab-sided, raw-boned, slow-maturing animal, valued more for its wool than its mutton qualities, but Bakewell's Improved or "Dishley Leicester" was a meat producer par excellence, quick-maturing and symmetrical.

In the days when most of Britain's grain was sown, harvested and threshed by hand, there was but little pasture as we know it today and the livestock of many owners grazed together on "common lands" where they interbred at will. Under these conditions it was almost impossible to improve stock by selection or by scientific feeding and although a number of different breeds had been evolved to suit conditions in particular districts, there was but little uniformity even within the breeds.

BREEDING AND FEEDING

With the introduction of land enclosure, various individual stock owners embarked upon programmes of breed improvement, and Bakewell, born in 1725, concentrated on Leicester sheep and Longhorn cattle, from about 1755 onward, with marked success.

This "father of studbreeding" was a secretive individual and little authoritative information exists concerning his methods but it seems certain that his success was achieved by selecting suitable animals and inbreeding them and their progeny to a degree that was frowned upon by breeders of that period. His critics, and they were many, voiced some caustic comments upon these "incestuous matings" but the results he achieved gained him many followers and imitators.

Bakewell concentrated upon meat production, probably having realised that the progressive industralisation of Britain, then taking place, would result in a rapidly-expanding market for foods of all kinds. It was the era of large fat joints, and the Dishley Leicester was developed to give a rapidly-maturing animal which combined the fatness of maturity with the tenderness usually associated with lamb. Bakewell fed his sheep well and grew root crops especially for them.

We speak today of "progeny testing" as the only satisfactory index of an animal's true value, and Bakewell realised that too. He used to hire out his rams to neighbouring farmers and closely observed the quality

of their "get." Early in his sheep-breeding career, the rams were let out for 17s. 6d. a head but a few years later we find him getting 100 guineas a head.

In 1786 he let two-thirds of the service of one ram for 200 guineas. His highest rate was 800 guineas from two breeders for two-thirds of the season's services of his favourite ram. A "Dishley Society" was formed which was incidentally the first British breed society to come into being and members pledged themselves not to use rams which did not belong to Mr. Bakewell or other members of the society.

IMPROVED MANY BREEDS

The Leicester in its improved form was highly prepotent and was used to improve many other "rough" longwool breeds then existing, and even some of the Downs breeds. It played a part in bringing the Lincoln to its present state of near perfection; the popularity of the Border Leicester is due to its Dishley foundation and the Dorset Horn and Romney Marsh sheep also benefited by infusions of Leicester blood.

The Leicester played its part in improving the early Australian flocks and soon became a popular breed in the North American settlements. Nearer home it received a particularly favourable reception on the Yorkshire Wolds where the breed was believed to have been introduced by that famous sportsman and stockbreeder, Sir Tatton Sykes of Sledmere. Today the Wolds are the chief centres for Britain's Leicester stock.

It was in the Wolds district, at Driffield in the East Riding of Yorkshire, that the Improved Leicester Sheepbreeders' Association was formed about a hundred years later (1893) and it was soon after the formation of this breed society that the Leicester Flock Book came into being.

MEAT BEFORE WOOL

Bakewell's concentration on meat production in his Dishley Leicesters is claimed by his critics to have led to a deterioration in the quality of the fleece, together with some loss of prolificacy, for the production of twin lambs was considered undesirable. He maintained that it was beyond the capacity of any ewe to bring to their full foetal growth two such lambs as he desired. Possibly his policy of in-and-in breeding also resulted in some lack of sexual vigour in the rams and a lowering of the milk production of the ewes, the best milkers among ewes being usually found in the more primitive or "unimproved" sheep except in a few breeds where breeding for milk production has taken place.

Whether these faults actually existed or not may be open to doubt, but if they did exist they seem to have been remedied by subsequent breeders.

The modern Leicester is a shapely-bodied sheep of sound constitution. According to present-day standards the meat is rather too coarse of grain and carries too much fat to be popular in its mature stage though favoured as hogget mutton. The various crossbreds with Leicester parents give excellent mutton, and the female progeny of Merino ewes and Leicester rams produce excellent export lambs when mated with rams of the Downs breeds.

POINTS

The following recognised description of the English Leicester is taken from the flock book of the Australian Society of Breeders of British Sheep:—

Head and Face.—Head carried well, not too high; neat, cleanly chiselled, wide between the ears, slightly tapering to the nostrils; no sign of horns, and carrying a light forelock. Face, in general, is wedge shaped and covered with short white hairs; lips and nostrils black; black specks on face and ears not objectionable.

Eyes.—Full-sized and bright.

Ears.—Medium-sized and alert; black spots not objectionable.

Neck.—Medium length, strong and level with back.

Shoulders.—Upright and wide over the tops.

Chest.—Breast should be deep, wide, and prominent.

Back.—Wide and level, well filled up behind the shoulders, giving a great girth, showing thickness through the heart, and carrying firm even flesh.

Ribs.—Well sprung.

Hindquarters.—Full-sized and square, showing good legs of mutton; tail well set on, almost level with the back.

Legs and Feet.—Legs straight, well set on and wide apart; short cannon bones, good pasterns, not sloping, and devoid of reddish hairs on legs; hoofs black.

Skin.—Healthy pink colour.

Carriage.—Free and active.

Fleece.—Dense, free, even, and lustrous; lock medium width, showing small, well-defined wave or crimp from skin to tip.

Constitution and General Appearance.—Alert, robust, showing style and character.

Covering.—The Leicester carries a fairly weighty fleece of lustrous wool nine to ten inches in length and having a spinning count of 36-40 or finer. The average clean-scoured yield is in the vicinity of 72 per cent. and the wool is dense and even in good specimens of the breed, with the fibres carrying three to four well-defined crimps to the inch. The wool is especially valued for use in damasks, dress fabrics, braids and bunting.

PIG LICE

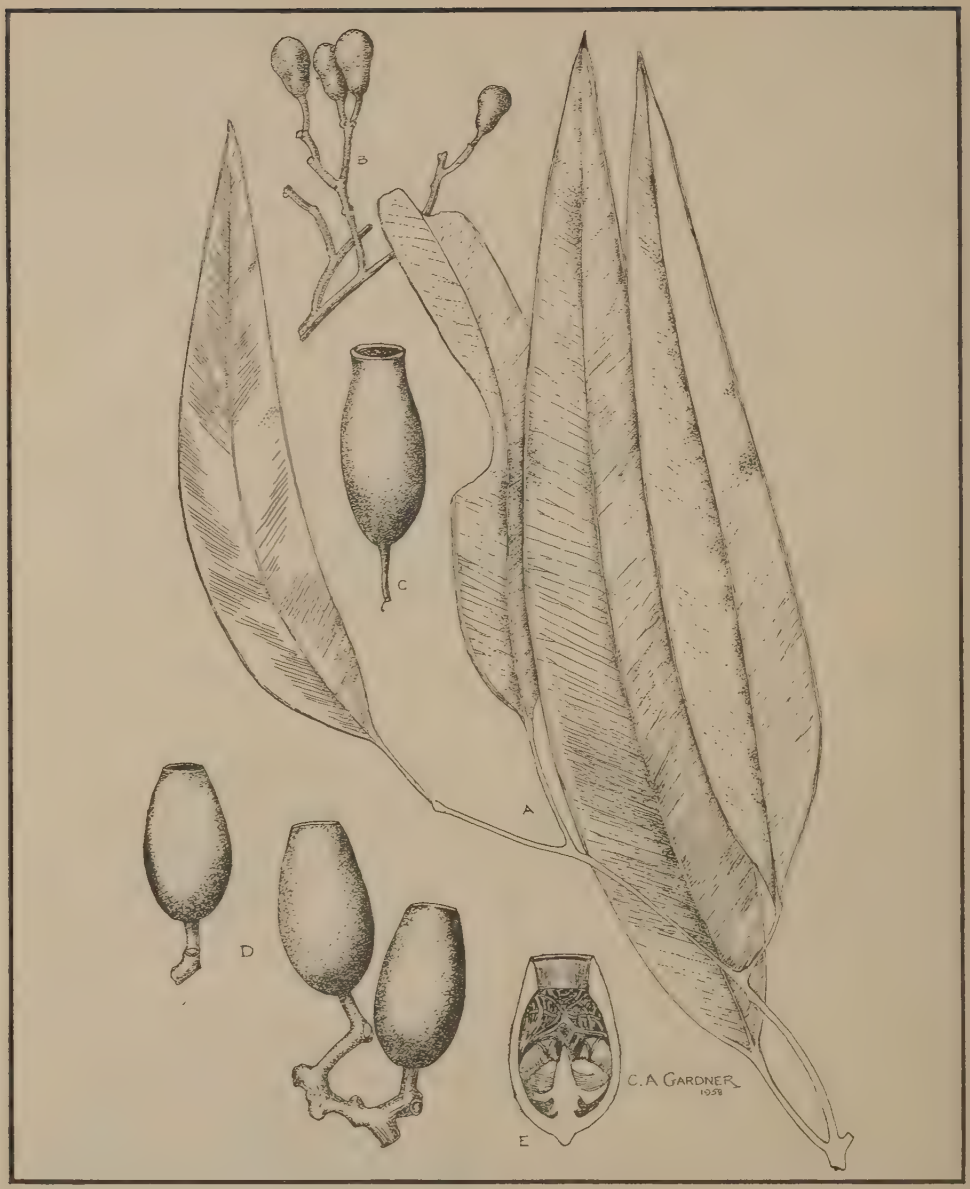
During the past 12 months action has been taken by the Department for the control and eradication of pig lice and the incidence of infestation as judged from market inspections has been considerable reduced.

Progress has been retarded by the practice of some farmers of selling their pigs under fictitious names as a means of avoiding taxation and where lice-infested consignments are involved, it is not possible to trace the pigs to their source and to take action for the eradication of parasites.

This situation can no longer be tolerated and at markets such as Northam, Merredin and Narrogin where it has become the practice to use fictitious names, action will be taken to prevent the sale of pigs found infested with lice until the owner has declared himself and his identity has been definitely established.

It has been the policy to warn owners of infested pigs upon the first offence and to furnish them with free information on eradication measures and to quarantine their properties should the offence be repeated. This has produced the desired effect and there have been few second offenders.

It should be appreciated that a heavy infestation of lice can seriously retard the growth of young pigs and that it is in the best interests of the owner to keep his herd free of the parasites.



LONG-FRUITED BLOODWOOD
(*Eucalyptus polycarpa* F. Muell.)

A—Leaves; B—Flower buds; C and D—Fruits; E—Section of Fruit

TREES OF WESTERN AUSTRALIA

Eight Eucalyptus Trees from the Tropical North

By C. A. GARDNER, Government Botanist

No. 47—LONG-FRUITED BLOODWOOD

(*Eucalyptus polycarpa* F. Muell.)

THIS tree which attains a height of 35 to 40 ft. is one of the common rough-barked trees of the open woodlands of the Kimberleys where the soil is sandy, and it is often associated with the woolly-butt (E. miniata).

The bark is usually a dark grey in colour, and it is sometimes, but erroneously called by the local inhabitants "Ironbark,"—a name that should be reserved for *Eucalyptus jensenii*. Unlike the ironbark which has a hard black or dark-grey bark, this bloodwood has a friable bark which is brown in fracture, and the timber is red and rather soft. The bark is also somewhat tessellated, while that of the true ironbark is deeply longitudinally fissured.

The tree has a wide range from southern New Guinea to the northern parts of Australia. In Western Australia we find it occurring from Broome and Derby, where it occurs in red sand, to the high plateau country to the north of the King Leopold Range, where it occurs commonly in the messmate woodland (*E. tetrodonta*), being very common on the low sandy flats, especially between the Edkins Range and Karunjie.

No. 48—MOUNTAIN BLOODWOOD

(*Eucalyptus terminalis* F. Muell.)

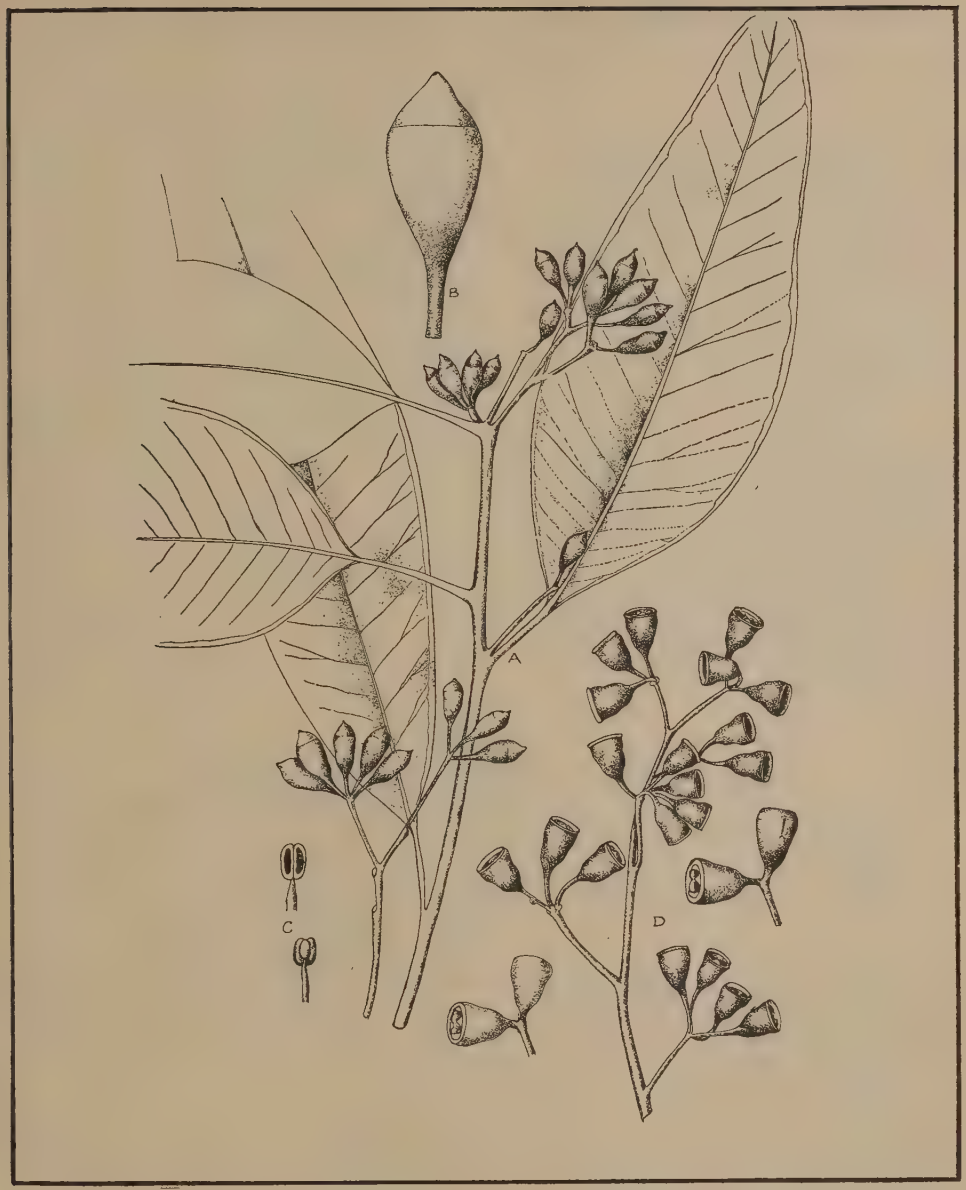
THIS bloodwood has been found in a few spots in the Kimberleys. First collected on the summit of Bold Buff in 1904 by Fitzgerald, it has subsequently been found at Gibb River and on high stony hills near Karunjie. The accompanying plate was made from material collected at Gibb River in 1952.

The tree has a smooth white bark which sheds in thin plates, and is more persistent and scaly and mottled with reddish patches near the ground. The leaves are a dull green in colour and rather thick, and the buds and fruits are on long stalks, the buds in particular being covered with small scurf-like scales. A feature of some of the trees is that they tend to produce thin grey hairy leaves resembling sucker leaves on their smaller branches. This may not be sufficient to entitle such trees to a distinctive specific name. The bloodwoods of tropical Australia are difficult to determine because many are only known from inadequate fragments, some in bud only, others consisting of fruits.

The timber of *E. terminalis* is red and the tree secretes an appreciable quantity of kino from its bark. The kino is deep red in colour and not unlike that of the common marri or red-gum of the South-West.

MOUNTAIN BLOODWOOD
(*Eucalyptus terminalis* F. Muell.)

A—Leaf; B—Abnormal leaves; C—Flower buds; D—Section through flower bud; E—Fruits; F—Section through fruit
Gibb River, *Gardner* 9923.



MOUNT HOUSE BOX
(*Eucalyptus argillacea* W. V. Fitzg. ex Maiden.)

A—Leaves and flower buds; B—Flower bud enlarged; C—Anthers; D—Fruits
Mount House, *Gardner* 10051 (1952.)

No. 49—MOUNT HOUSE BOX

(*Eucalyptus argillacea* W. V. Fitzg. ex Maiden)

THIS tree appears to be confined in its typical form to the clay shale flats which extend from Mount House to N.E. Mount Clifton between the Adcock and Throssell Rivers. It is a small tree, seldom exceeding 30 ft. in stature, with widely-spreading branches, a light grey rough (typically box) bark, and a dense reddish-brown timber.

The name *argillacea* refers to the grey clay which supplies the necessary soil for its existence. It is curious that this tree should be so completely restricted to this environment. The species has been recorded from near Mount Isa in Queensland, but the trees known under this name from Moola Bulla and the upper Ord River probably belong to a different species, the flowers and buds being unknown.

No. 50—YELLOW JACKET

(*Eucalyptus lirata* W. V. Fitzg. ex Maiden)

IN May, 1905, Mr. W. V. Fitzgerald, a member of Crossland's trigonometrical survey party, climbed Bold Bluff in the King Leopold Range, and collected on the summit the first specimens of Eucalyptus lirata, which he named from the circumstances of its occurrence (ridges of soil between rocks), from a Latin word with this meaning, or more correctly ridges between furrows.

The small original specimens were in fruit only, and the only fragment collected came into the hands of the National Herbarium in Sydney. Nothing further was known of this species until the writer on May 25, 1952, made an attempt to climb Bold Bluff. The condition of the track and other factors made it impossible to get within about eight or ten miles of our objective, and another mountain was climbed, Mount Felix, where close to the summit this strange tree was found growing on ledges of soil alternating with quartzite rocks—a tree with a yellow fibrous bark not unlike a paperbark teatree, but of more open texture. The original specimens were in fruit only, but the new locality yielded a fallen twig with dead buds attached. The species is thus adequately illustrated for the first time on the accompanying plate. Notable features are the twisted filaments, and the cylindrical thin-rimmed fruits with pale yellow triangular concave valves protruding beyond the rim. The tree is about 20 ft. tall with slender branches and a relatively short trunk covered with this remarkable bark which consists of thin, flaky, easily-separable layers of a delicate texture inter-spaced with longitudinal fibres. The leaves are a pale green in colour. It is curious that this species should be restricted to such isolated altitudes.

No. 51—MOUNTAIN WHITE-GUM

(*Eucalyptus Mooreana* W. V. Fitzg. ex Maiden)

THIS tree, discovered in 1905, is a small crooked tree less than 30 ft. tall, with a short trunk, both the trunk and branches having white smooth bark, and a tough, moderately hard reddish timber.

The leaves are always opposite and stalkless, with those of each pair often joined together at the base, pale grey-green in colour, and up to six inches in length and four inches in breadth, thick and rigid and conspicuously veined. The flowers are white. Little is known of this tree which was collected in the King Leopold Range in a few elevated spots: summit of Mount Rason (not far from Mount Hart); summit of Mt. Broome (3,040 ft);

YELLOW JACKET

(*Eucalyptus lirata* W. V. Fitzg. ex Maiden.)

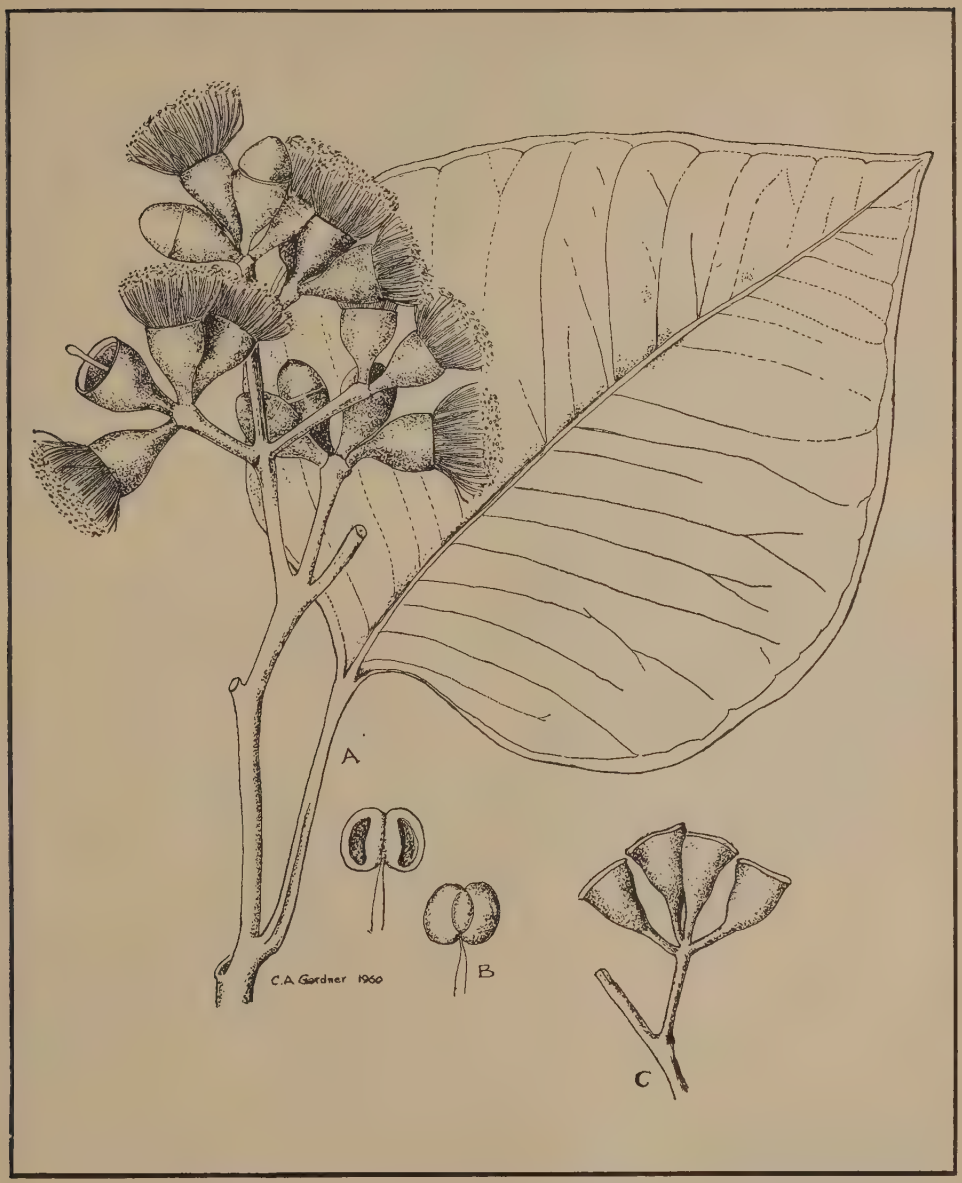
A—Branchlet with fruits; B—Flower buds; C—Flower (enlarged); D—Calyx-tube after flowering; E—Anthers
F—Branchlet with fruits; G—Fruit (enlarged); H—Section of fruit; I—Seeds

Gardner 11827 Mount Felix.

MOUNTAIN WHITE-GUM
(*Eucalyptus Mooreana* W. V. Fitzg. ex Maiden.)

A—Pair of leaves and two umbels of flower buds; B—Mature leaves and flowers; C—United bracts which protect the young flower-buds—the cluster of buds being inside this globular organ; D—Anthers; E—Fruits; F—Single fruit in profile

(The species is named after Sir Newton J. Moore, a former Minister for Lands, subsequently Premier, and then Agent-General in London for Western Australia)



Eucalyptus oligantha. Schau.

A—Specimen collected by A. Cunningham at Copeland Island; B—Anthers; C—Fruits

Bold Bluff (2,760 ft.); and Mount Leake (2,246 ft.). It is thus a tree confined to high altitudes and of very restricted occurrence, growing among quartzite rocks. It does not appear to have any close relatives.

No. 52—(*Eucalyptus oligantha* Schau.)

THIS tree is an imperfectly-known bloodwood which was first collected by Alan Cunningham in 1819, when attached to the Admiralty explorations of the north and north-west coasts under Captain King.

It remained undiscovered until August, 1905, when W. V. Fitzgerald collected specimens between Tabletop Mountain and the Artesian Range, and again by Gardner in the Artesian Range in October, 1921. The tree grows to a height of about 40 ft. with a short trunk up to 12 in. in diameter, the bark being thick, but with the outer layers shedding in thin papery flakes. The timber, like that of the other bloodwoods, is red. It grows in quartzite country. The mature fruits have not been observed, and the accompanying plate was taken from an illustration of the original specimens collected by Cunningham at Copeland Island.

No. 53— (*Eucalyptus brachyandra* F. Muell.)

THIS tree has no recognised common name. It is a species which, in Western Australia is not found further south than the Charnley River in the Kimberleys, although very common between the Charnley and Prince Regent River to the north, and eastward to the King Edward River.

The largest trees to be seen are probably those which occur between the Glenelg and Prince Regent Rivers, where the highest rainfall in tropical Western Australia occurs. Here, as a crooked tortuously-branched tree, it is found growing, often in scanty soil among rocks, sometimes in almost inaccessible spots. The largest trees would not exceed 30 ft. in height, but the trunk is commonly 20 in. or more in diameter. The trunk and branches are covered with a rough, fissured, reddish-grey fibrous bark thoughout. The timber is deep, and very hard and tough. The most interesting features of this species are the very small flowers, and the relatively small, broad and obtuse leaves, together with its habit of becoming completely leafless during the dry winter months. The specific name refers to the short anthers.

No. 54—VARIABLE-BARKED BLOODWOOD

(*Eucalyptus dichromophloia* F. Muell.)

THIS is the common bloodwood which grows along the Fitzroy, Lennard, Margaret and Ord Rivers, as a robust tree with pale pink or white bark marked with reddish-brown flakes on the trunk, and a reddish-brown timber.

It is particularly abundant on the low-lying country around Fitzroy and Gogo. It takes on a number of forms however: on the high stony country along the King Edward River is a form with a persistent rough bark, and this form may be seen as far south as the Ashburton River; while a third smooth-barked form with very narrow leaves extends southwards to the Murchison River near Mount Narryer. The shape of the fruit is fairly constant, although some forms are much more contracted at the orifice of the fruit than those depicted, while in length they vary from about half to one inch. The name *dichromophloia* refers to the variable colour of the bark.

(Eucalyptus dichromophloia F. Muell.*)*

A—Branchlet with leaves and panicles of flower-buds; B—Flower buds (enlarged); C—Two buds showing the deciduous calyx teeth; D—Flower bud about to open; E—Flower; F—Anthers; G and H—Fruits; I—Section of fruit

Artesian Range, *Gardner* 1621.

VARIABLE-BARKED BLOODWOOD
(Eucalyptus dichromophloia F. Muell.)

A—Leaf; B—Flower-buds; C—the same; D—Fruits; E—Longitudinal section of fruit; F—Small fruited form; G—Anthers; H—Seed

A-C Gardner 10067. D-E-G-H, Gardner 9727, Gogo, October 1950; Fossil Downs Gardner 10067, Apl. 1951;
F—15 miles N.W. from Kalumburu, H. N. Speck, 4909.

Contour Banks for FILLING DAMS

By B. a'B. MARSH, B.Sc. (Agric.), Adviser, Soil Conservation Service

ALTHOUGH contour banks have been used in this State for many years to lead water into earth tanks or "dams," it is only comparatively recently that the idea has become really popular. Thanks to the publicity given to this matter during the last three years many farmers now know that dams may be filled by contour banks, but because they do not know the finer points of the method, they are apt to mislead themselves into thinking that their territory is unsuitable for putting it into practice.

If your dam does not fill as readily as may be desired, it is best to consider using contour banks before incurring greater expense.

Even though your particular piece of country does not appear to offer much scope, don't dismiss the idea as impracticable until you have made some test surveys.

Assume that the contour banks will run the water to the right spot and act on this belief by surveying the lines, no matter

Fig. 1.—Contour banks can be used to fill dams with water and in doing so can collect water from hazardous areas where erosion might otherwise occur

Fig. 2.—Though dams across gullies might help to heal erosion, there is always the danger of further erosion silting the dam; furthermore, the overflow must re-enter the gully and headward erosion could cause severe damage to the dam. It is better to place the dam elsewhere and lead water to it from the adjacent slopes and depressions

how sceptical you may be. You may find that your first impressions were right—but the chances are that you will be pleasantly surprised to find that contour banks can provide the answer to your water supply problems.

The eye is often deceived. Most of you have seen water which apparently runs uphill along contour banks. Even confronted with indisputable evidence we find it hard to believe that the line runs downhill. How much less reliable is the evidence of the eye when there are no contours surveyed.

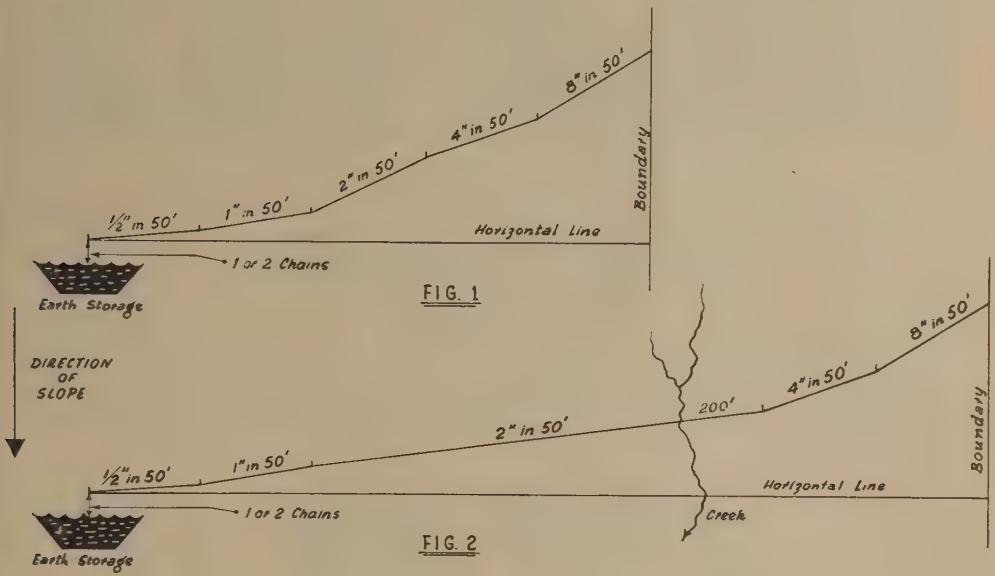
My advice is to ignore your "snap judgments" completely and to go ahead with the surveying of the lines. No special ability is required—a hose level used in accordance with instructions in Department of Agriculture Bulletin No. 2284, is simple to operate and will pay for itself in a few hours.

Begin surveying about one or two chains above the excavation in order to give water a chance to spread out as it flows down to the dam. (If water is concentrated into the corner of a dam much erosion damage can result). Commence surveying so that each succeeding peg is 50 ft. away and ½ inch higher than the last. After about 100 yards you will see where the line might be headed and you will know approximately how long it might be. Continue the ½ inch rises for a total of about one-fifth of the estimated length of the line. After this increase to 1 inch in 50 ft. for a quarter of the remaining distance. For about the same distance again raise this to 2 inches in 50 ft. At this stage, try to judge whether the line will cross any depressions likely to run much water. If it seems likely, then continue on the 2 inch in 50 ft. rises till the creek or creeks are passed and for about 200 ft. past the creek. Whether creeks are crossed or not, at the end of the 2 inch fall section increase the grade to 4 inches in 50 ft. for half the remaining distance and the last section should be increased up to 8 inches in 50 ft. This last section should not be more than 10 chains long otherwise it might erode. Keep surveying until a fence or rocky ridge prevents the line going further. Rock heaps can be dodged by increasing the bank slope to cause the line to pass uphill from small rock heaps, or resurveying the whole line higher up in the case of larger obstructions.

Along this surveyed line, a contour bank should be built (see Bulletin No. 2335—

"Building Contour Banks with a Disc Plough"). A road grader can be used This bank should be about 18 inches high and the channel must be flat and wide, certainly not a "V drain" otherwise serious erosion will occur.

the outlet, usually with a maximum of only 2 inches in 50 ft. Such banks can run water only very slowly in most rains and will only run water in quantity in excessive rains—when the water can achieve sufficient depth to make it run.



This surveyed line can be any length up to a mile long if desired, and preferably not less than 15 chains, unless a creek is to be diverted into the bank.

The alterations in grade can be represented diagramatically as shown in Figs. 1 and 2.

The gradual decrease in grade towards the storage is designed to achieve the maximum and most efficient flow. A uniform grade or an increasing grade, will not allow water to accumulate as it flows and as a result it will run slowly and tend to soak in. With a decreasing grade as suggested, the water at the top end runs faster than the water collecting in the lower section and so is able to catch up and add to the flow in volume; this increases its speed of the water and its chances of reaching the dam. At the flat end of the bank, the water has depth so needs little or no slope to make it flow.

Contour banks for soil conservation are designed with an increasing grade towards

Do not be worried by salt creeks. Dams can be placed up the slope well away from underground salt water and still be fed by contour drains. Dams can also be placed anywhere convenient where there is holding ground. Contour drains can cross most salt creeks unless they run salty water for long periods. Normally, creeks and gullies showing signs of salt run fresh water during rain and it is not dangerous to collect this water.

It is not possible to make a rule as to the length of bank or size of catchment to fill dams of certain sizes, as there are too many variable factors. It is advisable to place contour banks leading into the dam from both sides and from as far away as possible. This method of filling dams can be used anywhere in Western Australia where dams can be built and where there is any slope to the land. Even in the dry areas, falls of reasonably heavy rain do occur and it is these that will fill the dams.

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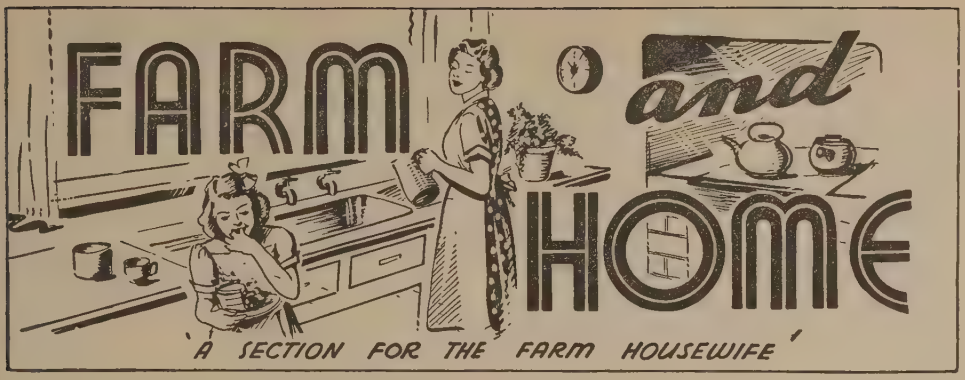

SIMNEL CAKE

By HELEN M. GLOSTER

THIS is a traditional cake of English rural origin that is usually served on "Mothering Sunday" or Mid-Lent Sunday (the fourth Sunday in Lent). Mothering Sunday is the day on which sons and daughters visit their parents and take them gifts. Quite often the gift takes the form of a Simnel cake.

Tradition has it that when young girls left their parents' homes to go into service, the New Year was the time of the year when they commenced their duties and Mid-Lent was the time they were given their first leave to visit their homes. Naturally they liked to show evidence of their progress in cooking and usually each took a Simnel cake with her. Quite often these cakes would be kept until Easter. Like Christmas cakes they keep well.

The custom has grown and in modern times many young people away from home make a point of visiting and honouring their parents on "Mothering Sunday" if this is at all possible.

Concerning the unusual name of the cake, one story tells of a young couple Simon and Nellie who disagreed as to the manner in which the cake should be cooked. In the end they compromised, first boiling then baking it. Certainly many old recipes for the cake give directions for boiling then baking the cake.

Another possible origin of the name is the latin word "simila" which means "the finest wheaten flour."

The modern version of the Simnel cake is a rich fruit cake, iced with almond icing. Half the almond icing is sometimes put as a layer in the centre of the raw cake mixture and baked as part of the cake.

It is a suitable cake for the Easter season itself as it may be baked weeks beforehand and stored.

SIMNEL CAKE No. 1

Ingredients.

1 lb. plain flour.
½ lb. butter.
½ lb. castor sugar.
5 eggs.
Grated rind 1 lemon.
Grated rind 1 orange.
2 level teaspoons baking powder.
½ lb. sultanas.
¼ lb. mixed peel.
½ lb. raisins.
¾ lb. currants.
¼ cup brandy.
Level teaspoon ground ginger.
Level teaspoon ground cinnamon.
½ level teaspoon grated nutmeg.
Almond paste.

Method.

Wash and dry the fruit, removing stalks and seeds from raisins, mix with a tablespoon of the measured flour.

Line a cake tin with **two** layers of kitchen or grease proof paper.

Cream butter and sugar until grain disappears from the sugar.

Beat in yolks of eggs one at a time, then add brandy.

Add spices and grated rinds.

Fold in the flour and stiffly beaten whites of eggs.

Stir in prepared fruit and baking powder at the last minute.

Place mixture in prepared cake tin, level the top and bake in a moderate oven 2 to 3 hours.

Store cake for 3 or 4 weeks and ice a few days before cutting.

TO ICE SIMNEL CAKE

Ingredients.

1 lb. ground almonds or finely minced almonds.
½ lb. fine castor sugar.
½ lb. icing sugar.
Juice ½ lemon.
Yolks or whites of eggs sufficient to bind mixture.
1 or 2 tablespoons brandy.
Orange flower water, vanilla or other flavouring.

Method.

Mix dry ingredients together.

Add brandy essence and lemon.

Add sufficient beaten eggs to make a stiff paste.

Roll out the paste and spread smoothly over the top of the cake.

Score across the paste with a fork.

Decorate edge with little "eggs" made from almond paste (for an Easter cake only).

Brush over the top with a coating of beaten yolk of egg.

Brown in a moderate oven or brown under a gas grille.

N.B.—Sometimes half the icing is made up when the cake is being prepared. Half the raw cake mixture is put in the cake tin, then a rolled out layer of almond paste placed over this, and remainder of cake dough on top.

Bake as in previous recipe.

ALMOND PASTE

A cheaper recipe which is quite satisfactory as an icing.

Ingredients.

½ lb. almond meal.
½ lb. castor sugar.
½ lb. icing sugar.
Few drops pure almond essence.
Juice of medium orange.
Sufficient brandy to make a stiff dough.
Egg yolk may be used or omitted as desired.

Method.

Mix well to a stiff dough using a mixture of orange juice and brandy to moisten.

Brandy may be **omitted** if desired.

ANOTHER RECIPE FOR SIMNEL CAKE

Ingredients.

The Paste.

8 oz. ground almonds.
8 oz. castor sugar.
Few drops almond essence.
Egg for mixing.

The Cake Mixture.

4 oz. butter.
4 oz. castor sugar.
2 eggs.
Brown colouring.
Vanilla.
4 oz. currants.
4 oz. sultanas.
1 oz. mixed peel.
Level teaspoon mixed spice.
4 oz. flour. (1 oz. self raising; 3 oz. plain).

Method.

The Icing.

Make the almond paste by mixing almonds, castor sugar and essence.

Mix to a stiff dough using beaten egg.

Roll out into a sheet about half an inch thick and cut a circle the size of the cake tin (use about half the paste).

The Cake.

Line cake tin with paper.

Clean fruit by washing, drying and **removing** stalks from sultanas.

Cream butter and sugar.

Add **beaten** eggs, beat well.

Add brown colouring to make cake a deep coffee colour.

Add essence.

Add dried fruit and finely chopped peel.

Sift flour and spice.

Fold in sifted flour.

Put half the cake mixture in the paper lined cake tin.

Smooth the surface and cover with the disc of almond paste.

Place remainder of cake mixture on top.

Smooth the top and bake in a slow to moderate oven for about 2 hours (300° F.).

Turn on to a wire tray to cool.

Icing the Cake.

Work remainder of paste into a ball and roll out about ½ inch thick.

Cut a circle the size of the cake.

Cut a smaller circle 4½ in. in diameter from the disc making a ring.

From the smaller circle shape small "eggs" about the size of a walnut.

Place the ring on the cake and mould firmly into position.

Space the "eggs" evenly in a circle on top of the almond paste.

Brush paste over with beaten egg and place in a hot oven until "eggs" are golden brown in colour.

When cake is cold, ice centre with plain icing.

Cake may be decorated with crystallised cherries and angelica for festive occasions.

EASTER CAKE

Ingredients.

¾ lb. flour.
¼ lb. butter.
¼ lb. sugar.
2 oz. currants.
2 yolks eggs.
1 white of egg.
1 teaspoon brandy.
Pinch salt.
Castor or icing sugar for dredging.

Method.

Clean currants thoroughly by washing and drying.

Cream butter and sugar.

Add eggs then brandy beat well.

Work in flour by degrees, adding a little milk if necessary.

Work in the currants.

When smooth and free from cracks, cover the paste and leave for at least one hour in a cool place.

Roll out on a floured board to less than ¼ in. thick.

Using a saucer or plate cut into 5 in. rounds and place on a greased slide.

Bake in a moderate oven until brown and crisp.

When **almost** cooked brush over with slightly beaten white of egg and dredge with castor or icing sugar.

Cool cake before storing.

N.B.—Wrapped in fancy cellophane paper and tied with ribbon a few of these cakes would make attractive Easter gifts.

STRYCHNINE POISONING

Poisoning by strychnine occurs occasionally in various classes of farm livestock, but dogs are by far the most frequent victims as they often pick up baits laid for dingoes and foxes.

The symptoms of strychnine poisoning are that the animal goes into violent convulsions followed by stiffening, with the back and limbs rigid and head drawn back.

Where the services of a veterinary surgeon are available, the dog should be taken to him without delay as he can treat the dog with an anaesthetic to prevent further convulsions.

If no vet. is available, place the animal in a comfortable position, preferably in a quiet, dark place, and **do not disturb it.**

Many valuable dogs have been killed by well-meant efforts to make them vomit after the symptoms of strychnine poisoning have appeared. Any form of rough treatment is apt to bring on further convulsions which usually cause death.

On the rare occasions when the dog is seen to swallow a bait, no time should be lost in inducing vomiting. If the bait is taken near the homestead, one or two crystals of washing soda poked down the throat will cause vomiting. Common salt and mustard mixed with water and given as a drench will have the same effect.

A common "bush" remedy is to push a wad of tobacco—or a cigarette broken up and moistened—down the dog's throat.

The frequency and violence of the convulsions—and the dog's chances of recovery—will depend on the quantity of strychnine ingested.

Remember that the best chance of saving a poisoned dog is to get him to a vet. without delay. If this is not possible, disturb the dog as little as possible once a convulsion has occurred.

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Rabbit Control

In 1960

By C. MARSHALL, Field Superintendent, Agriculture Protection Board

IN the year 1859, an enthusiastic sportsman in Victoria took delivery from the clipper "Lightning" of a small consignment of wild European rabbits which he joyfully released on his estate at Barwon Park, near Geelong, in order to assure himself of some rough shooting. He was not the only rabbit importer on record—tame rabbits were brought into Australia before and after 1895 and doubtless there were other importations of the wild rabbit—but he is generally credited—or discredited—with having triggered off the rabbit plague.

This year, therefore, Australia commences her second century, A.R. (After Rabbits) and 1960 promises to be a particularly important year in rabbit control history.

At present, rabbit numbers are at or near an all-time low, thanks to the unprecedented deadliness of the myxomatosis virus and the improved techniques and widespread application of our modern rabbit control methods. Any idea that the rabbit is a spent force, however—that it can no longer be regarded as a menace to Australian agriculture—must be combated by every means in our power.

The rabbit is a singularly defenceless animal, quite unfitted—except in one respect—for the grim battle of survival in a world intent upon its eradication.

That one exception—its power to reproduce itself in vast numbers—has enabled it to withstand successfully the heavy mortalities wrought by droughts, floods, fires, diseases, the attacks of its natural enemies and all the death-dealing techniques evolved by man.

Rabbit populations in Australia are, generally speaking, at a low ebb, but it has also become quite obvious to those people who are interested in the control of rabbits and have studied them in their natural surroundings, that any serious reduction in population numbers has the effect of stimulating breeding. This breeding may commence immediately following the cause of the reduction, or could be delayed temporarily until the reason for the upset has been forgotten, giving the remaining rabbits time and an opportunity to settle down and re-establish themselves. However, we can be certain that this upsurge in breeding will come if the pests are allowed to remain undisturbed.

This intensive breeding makes it important that all cover, warren, etc., should be destroyed, regardless of the apparent absence of rabbits following other successful control work.

A DIFFICULT YEAR

The 1959 season was a difficult year for most farmers. The unpredictable weather made conditions most trying. For rabbits, the season was in the main favourable. Fairly dry conditions throughout the wet South-West favoured continuous breeding. Losses of kitten rabbits from the flooding of warrens was low, and the general survival rate high, by comparison with the average year.

Strangely enough, the highest increase was noted in the North-Eastern districts. Normally, these areas do not favour heavy breeding during a dry season. Apparently, the present build-up is an example of the

rabbit's determination to re-establish strong colonies throughout these areas.

Control work undertaken during 1959 was not quite up to standard of the previous season and this factor, plus the decline in the myxomatosis virus killing power, was responsible for a noticeable increase in the number of rabbits which were alive at the beginning of 1960.

The decline in control work during 1959 was due to several reasons; a major one being the reluctance of some farmers to destroy warrens and cover, because these warrens shelter the mosquito that spreads the myxomatosis virus.

These farmers completely ignore the most obvious fact—that if they had no warrens, they would have no rabbits, and naturally, no need for the virus-carrying mosquito. They should also remember that warrens remain an open invitation for all stray rabbits to take up residence and, in addition, provide a protection against their natural enemies.

A second, serious impediment to vermin control, is that a certain section of the farmers value the rabbit commercially. They can now dispose of the rabbit carcass for local consumption at the attractive prices of 5s. to 7s. a pair. This has encouraged what we call "rabbit farming." Commercial trapping can only have one result—to increase the breeding rate and spread the rabbits to adjoining properties.

We will endeavour to stamp out this evil during the 1960 season. However, it is very difficult to obtain results if a section of the farmers refuse to co-operate.

FUTURE PLANS

The Protection Board's plans for 1960 include continuation of warren destruction work and organised poison drives. Gazetted drives will be conducted throughout all vermin districts during the months of January, February, March and April. Once again, "1080" and oats will be the principal bait but we would recommend that cut apple be used when available. A few pounds of apple bait added to the oat bait could prove most helpful in destroying any foxes that follow rabbit trails. The Department's "1080" units will be available to farmers who wish to take advantage of this service. However, I would like to make it quite clear that it is not compulsory for any farmer to employ our "1080" unit. He may do his own work if he so desires, always providing that he obtains results, and works within the drive dates, using the poison specified, and complying with the gazetted notice.

The Department's warren-ripping units will be working in the Mt. Barker, Cranbrook, Katanning and adjoining districts early in the year and will remain in those areas while work is available. Every farmer who has difficult warrens on his property should take advantage of this plant, while available; it may be years before they return to your district.

The Group Inspectorial Scheme extended rapidly during the past 12 months and the position today is most gratifying. We believe that 98 per cent. of the Boards who have co-operated with the Agriculture Protection Board in the formation and management of these groups are satisfied with the results obtained from our combined efforts and give full support to the objective of this scheme, which is the co-ordination of vermin control throughout our State.

SOME SOUND ADVICE

The following are a few points on rabbit control that are well worth repeating.

When planning your future rabbit control work do not depend on myxomatosis virus to produce a miracle.

Do not rely entirely on one type of control. Use all methods available.

Do not operate as an individual; insist on the "all-in" drive system for your district and work in conjunction with your neighbours.

Before commencing your work make sure that you know where the rabbits are living and feeding and lay your trails accordingly.

Do not stint the length of trail or miss small colonies. These are important.

Take a pride in your free feeding and feed according to the requirements of the rabbits visiting your trails.

Use only the best materials at all times and make sure everything is fresh and clean.

Always err on the generous side when laying poison bait. Make sure there is enough for all rabbits.

Destroy all cover, warrens, logs, bracken, etc. Remember the golden rule for rabbit control—no cover, no rabbits.

A MENACE—NOT JUST A NUISANCE

I believe that the average farmer is prone to forget past damage by rabbits to pastures and crops, and, unfortunately, is inclined to regard the present scattered population more as a nuisance than as a menace. We also have quite a number of younger farmers who have not experienced heavy rabbit invasion, and we sincerely hope they may never have to in the future. However, we are concerned that such an increase is a distinct possibility if the present trend of indifference is allowed to continue. The A.P.B. policy for 1960 will be more towards eradication than it has been in the past, always assuming that eradication is practical.

Most of our wheatbelt country could be freed of rabbits if proper attention was given to the destruction of cover. The same would apply to most of our Great Southern and Central districts. It is becoming clearer each season that the controlling of rabbits by poison bait is limited. To consolidate our gains we must destroy all cover.

In conclusion, I would like to thank the many farmers who have supported the Agriculture Protection Board's efforts during the past year and to remind all landholders that our success depends on your co-operation.

Gullying Wastes Good Land

There are areas of severe erosion in our farming areas. You may be worried by some on your own property. Less serious damage, which can get worse, is more in need of urgent attention and is easier to fix. Here is a horrible example of what erosion can do to good farm land.

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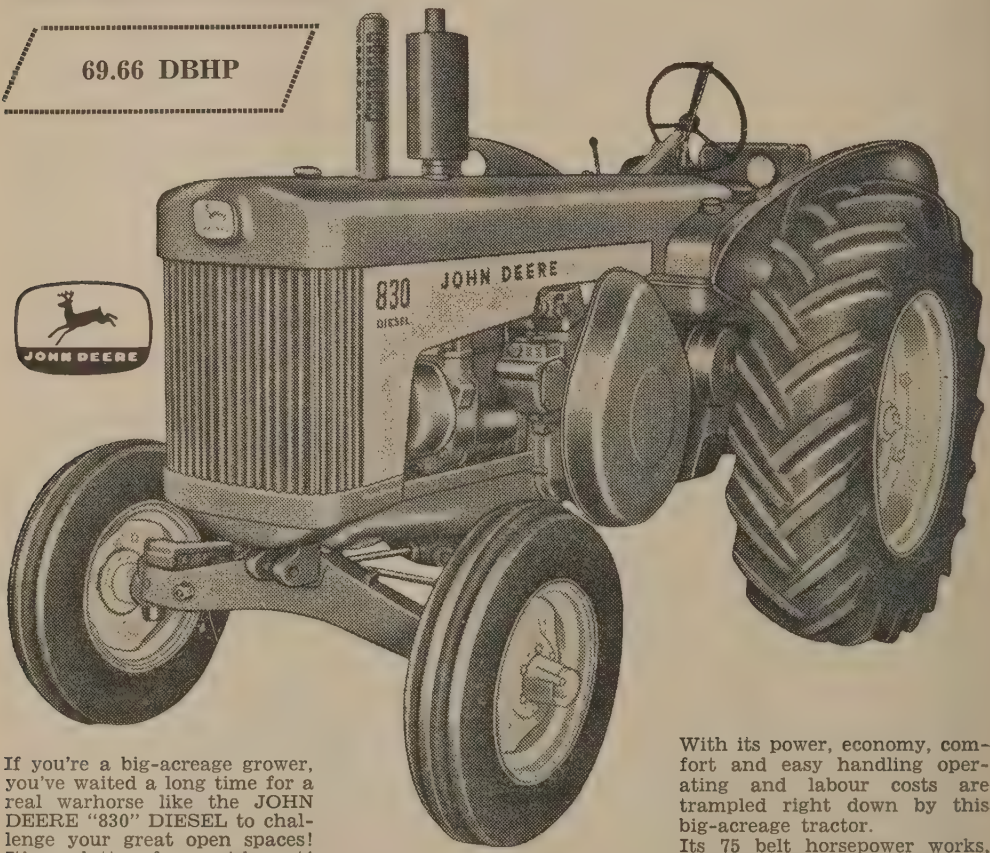

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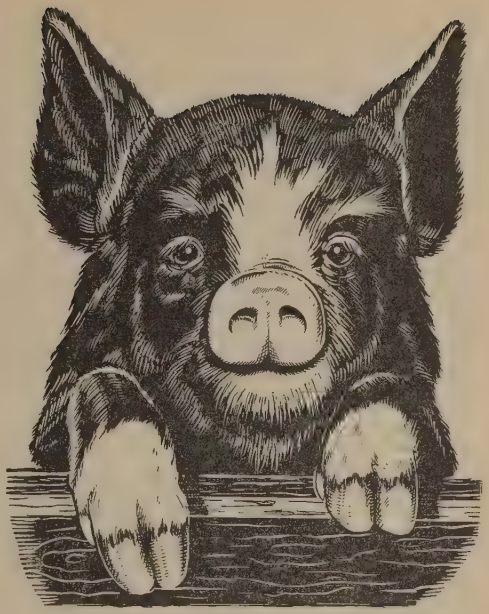

(CONTRIBUTED BY THE VETERINARY BRANCH)

INQUIRIES are frequently received from farmers asking whether it is safe to feed pickled wheat to pigs, and if so, the quantities which would be suggested. Until very recently there was no experimental information on the safety or possible dangers of these wheat pickling agents, but feeding trials completed last year at the Animal Health and Nutrition Laboratory, Nedlands, have provided some of the answers to these questions.

The trials were conducted in part by the Senior Veterinary Pathologist (M. R. Gardiner, D.V.M.), and in part by J. Armstrong, B.V.Sc., who is now located at Albany as District Veterinary Officer.

The four pickling agents in common use at the present time are as follows:—

Copper carbonate.

Ceresan (Organic Mercury Compound).

Fernesan (Tetramethyl thiuram disulphide —TMTD).

Hexabunt (Hexachlorbenzene C_6Cl_6).

Pickling was carried out at the standard rates of 2 oz. to the bushel and four groups of young pigs (slips and light porkers) were fed the following rations, which incidentally provided 18 per cent. protein.

	lb.
Pickled wheat	100
Meatmeal	15
Limestone	1
Salt	½
Vitamin "A" supplement.	

The animals were kept under close daily observation and the information obtained at the termination of the feeding trials may be summarised thus:

Copper Carbonate Pickled Wheat.

Two pigs were fed for 70 days and 120 days respectively on a diet which comprised approximately 87 per cent. pickled wheat, one eating 255 lb. (in 70 days) and

the other 355 lb. (within 120 days). During this period the pigs thrived and showed no visible ill-effects. No abnormalities were detected at post mortem, but analysis of their livers showed dangerously high levels of stored copper, so much so that it was surprising that the pigs did not develop copper poisoning.

Ceresan Pickled Wheat.

Two pigs each consumed 255 lb. wheat in 90 days. They thrived well and neither showed any clinical ill-effects; no carcass abnormalities were seen when the animals were slaughtered. However, analysis of their livers and kidneys revealed mercurial levels well above those permitted in food intended for human consumption.

Fernesan Pickled Wheat.

Two pigs each ate 269 lb. wheat in 61 days. They grew satisfactorily and in fact had weight gains of 53 lb. and 65 lb. respectively over this period. When the animals were post mortemed, a remarkable bright green discoloration of all the subcutaneous and visceral fat was seen, indicating fat storage of the Fernesan.

Hexabunt Pickled Wheat.

Two pigs each consumed 329 lb. wheat in 71 days. The animals thrived and showed weight gains of 50 lb. and 95 lb. respectively over this period. No visible abnormalities or discoloration of the carcasses were seen at post mortem, but analysis of liver, fat and muscle tissues revealed totals of organic chlorine well in excess of that permitted in food intended for human use.

DISCUSSION

No signs of clinical ill-health, or adverse effects on weight gain, feed consumption or feed conversion were seen in groups of young pigs fed on wheat containing four different pickling agents, at the intake of the pickled wheat attained in each of these trials.

No visible post mortem abnormalities were evident with the exception of the Fernesan group which showed a remarkable green carcass discoloration. Such green carcasses would of course be condemned by meat inspectors as unfit for human consumption.

However, chemical analysis of the animal tissues revealed copper levels as high as 4,400 parts per million, mercury levels as high as 300 p.p.m. and organic chlorine, calculated to B.H.C. levels, as high as 1,000 p.p.m.

New Food and Drug Regulations are about to be gazetted under the provisions of the Health Act. These regulations will be in conformity with those in other States, and will allow copper concentrations up to 30 p.p.m., and mercury concentrations up to 5.5 p.p.m., in meat and other foods. Livers and kidneys, and in all likelihood muscle and fat, from the pigs in question would therefore be unfit for human consumption.

Furthermore, the upper limit of tolerance generally accepted for B.H.C. is 5 p.p.m. and animal tissues with higher B.H.C. levels would also be unfit for human use.

CONCLUSION

It is quite clear that the feeding of pickled wheat at the levels described, whilst causing no obvious ill-effects in young pigs, does lead to the accumulation of pickling residues in animal tissues at levels considered a toxic hazard for humans and far in excess of those permitted by the Public Health Regulations.

Their indiscriminate use for feeding pigs cannot therefore be recommended.

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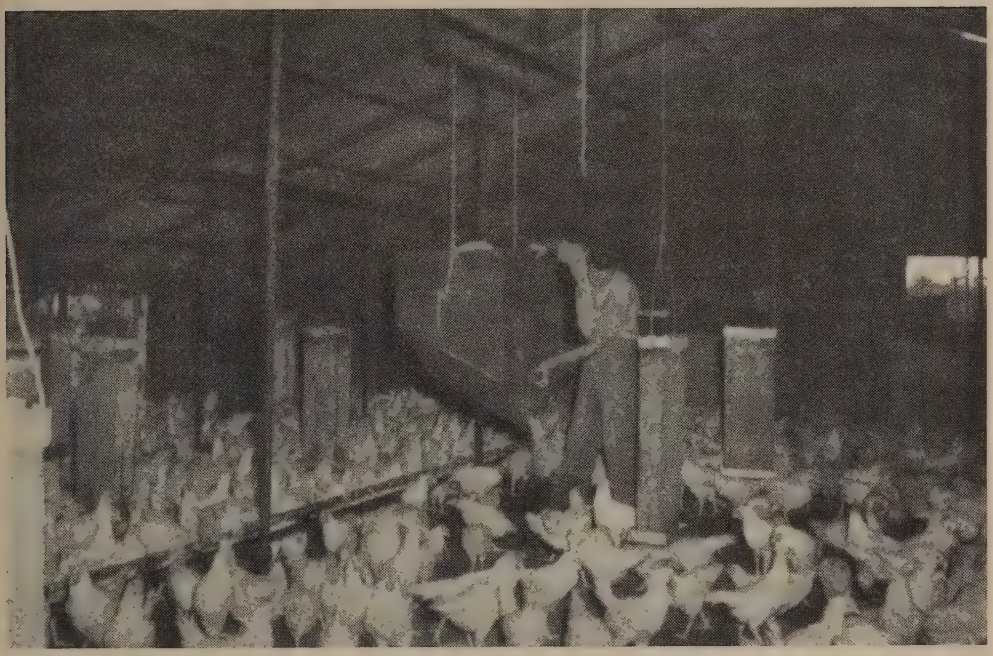

Fig. 1.——Interior of one of several large broiler houses on a farm at Wanneroo. Note the heavy concentration of birds, monorail feeding system and suspended feed troughs which allow greater floor space. The large feed bin, being operated by the attendant, moves freely along a monorail from the main storage bins and constitutes a considerable saving in labour

Better Rations for Broiler Production

By P. SMETANA, B.Sc. (Agric.), Adviser, Poultry Branch

DURING 1959, trials were conducted at the Poultry Research Station, Herdsman Lake, with the object of developing a broiler-feeding ration that was better than the one at present recommended by the Department of Agriculture and commonly used by local broiler producers.

The broiler industry in Western Australia has expanded rapidly during recent years and is still increasing, but when results achieved here are compared with those reported from overseas, it is obvious that there is scope for improvement in our methods.

Using standard rations and the ordinary first-cross cockerels, a typical result which can be expected in this State is a bird weighing 3 lb. at the age of 12 weeks, with a conversion ratio of about 3.5. Overseas literature claims the production of 3 lb. birds in eight to nine weeks with a conversion ration of less than 3.0.

It seems that we must pay attention to improved breeding and feeding methods, and possibly to better management, although in this field, the methods and techniques used here are more nearly comparable with those of overseas operators.

The trials discussed in this article were undertaken with the object of achieving greater weight gains at an efficient conversion ratio. The ultimate object was to formulate a ration which would be an economical proposition for broiler producers.

THE FIRST EXPERIMENT

The first trial tested a broiler ration containing a wide range of nutrients against the normal simpler diet commonly used in the industry and which will be designated here as the control ration. The two rations are shown in Table 1.

TABLE 1.
CONTROL RATION

Ingredient	0-6 Weeks	7-16 Weeks
	lb.	lb.
Wheatmeal	60	60
Bran	20	20
Dried Buttermilk Powder	4	..
Meatmeal (50%)	7	8
Whalemeal	7	8
Boneflour	1	1
	gms.	gms.
Manganese Sulphate	1½	1½
Vitamin A and D_3	As per manufacturers' recommendation	
Total	99 lb.	97 lb.

BROILER RATION

Ingredient.	0-16 Weeks.
Wheatmeal	55 lb.
Ground Oats	5 lb.
Bran	9 lb.
Whalemeal	9 lb.
Meatmeal	9 lb.
Dried Buttermilk powder	5 lb.
Dried Brewers' Yeast	3 lb.
Fat	5 lb.
Salt	4 oz.
Manganese Sulphate	10 gms.
Potassium Chloride	1½ oz.
Vitamin A and D_3	34 gms.
Riboflavin	200 mg.
Aureomycin Preparation	2 oz.
Calcium Panthothenate	400 mg.
Total	100.5 lb.

It will be noted that the broiler ration contains a total of 15 ingredients as against eight contained in the control ration. This increased number of ingredients does not necessarily constitute an advantage, but where maximum growth is concerned, a variety of ingredients would be more likely to supply the nutrient requirements. In overseas rations, there is a definite trend towards fully-supplemented rations.

It should be remembered however, that the number and choice of ingredients selected depends not only upon any increased weight gains thereby obtained, but also on the availability and the cost of each particular material.

One of the chief differences in the above rations is that the broiler diet has a considerably higher energy level than the control ration. The calculated productive energy value of the control ration is 780 calories per lb. of feed whereas the broiler diet contains 980 calories per lb., and can be classed as a high energy feed. It can be seen from Table 1 that the broiler ration has a higher proportion of grain to mill offal (which is low in energy), and this together with the inclusion of 5 per cent. fat accounts for the difference in the energy levels.

Experimental evidence obtained from the Poultry Research Station at Herdsman Lake as well as overseas literature has shown fairly conclusively that feed consumption is noticeably reduced with high energy feeds. This reduction is obtained without any decrease in body weight gains provided that the protein content is also increased. There is considerable evidence to indicate that the energy-protein ratio is of great importance with respect to the conversion ratio. The usual recommendation is to have a calories-per-lb. of feed to protein content ratio of about 42-45 to 1, but this figure should be determined according to the prices at which grain and animal protein can be purchased. Where grain is as cheap or even cheaper than the mill offals and animal protein is reasonably priced, then there is a definite financial advantage in using high energy feeds.

In this experiment, the control ration with an energy level of 780 calories per lb. and a protein content of 18 per cent. had a calculated energy-protein ratio of 45 to 1. The broiler ration had a slightly higher ratio (48 to 1) calculated from its energy level of 980 calories per lb. and a protein level of 20.5 per cent. It was felt that in the case of the broiler ration, which includes several costly ingredients, the cost of the extra protein required to bring the calorie-protein ratio to 45 to 1 was not

justified and a ratio of under 50 to 1 can be considered as fairly satisfactory.

The reason behind the inclusion of several ingredients in the broiler ration should be discussed here. It is important to understand that this particular ration is expensive and was not intended for direct practical application.

All ingredients which it was thought were necessary for optimum growth, except those that were unavailable or above a reasonable cost, were included in the diet.

Fig. 2.—Section of one of the broiler houses illustrating the heavy concentration of birds, hanging feeders and continuous water trough on left

The cost of the rations calculated on the average current prices at the time of the experiment was 5.72d. per lb., for the broiler feed and 4d. per lb. for the control ration. This price disparity between the two rations meant that a very marked advantage in favour of the broiler ration was required to offset the extra cost of feed.

The first five ingredients listed in the broiler diet are commonplace in many rations. Dried buttermilk powder and dried brewers' yeast have been included, despite the fact that they are expensive items. They comprise only 8 per cent. in quantity of the total ration yet they represent nearly 20 per cent, of the cost of the feed. Both ingredients however, are of high nutritional value as they are rich in vitamins essential to good growth as well as adding to the protein make-up of the ration. Most animal protein sources in this State are fairly low in biological value, therefore the inclusion of buttermilk powder (30 per cent. protein) and brewers' yeast (45 per cent. protein) contributes to the amino acid composition of the feed.

The inclusion of 5 per cent. fat or tallow has been standard procedure in broiler diets in the United States for several years and has recently become popular in the Eastern States of Australia. To my knowledge, fat products have been used at times by a few broiler growers in this State but it is not a common constituent of poultry rations here.

Besides its extremely high energy content which reduces feed consumption, and increases feed efficiency, fat is said to improve the vitamin stability of the feed as well as increasing its palatability. The fat used in this trial was high-grade white mutton tallow, and was obtainable at a cost of about 10d. per lb. Further mention of fat and its place in broiler feeds will be made in the discussion of the fourth experiment.

Salt and manganese sulphate were both included in the broiler diet. The necessity of salt in these rations is debatable, and it has been omitted in the control ration. It is very doubtful whether salt would have any bearing on the results. Manganese in the form of manganese sulphate has been added to both rations. A deficiency of this mineral is characterised by several harmful effects in poultry, but in broilers the most common result is a condition known as perosis or "slipped tendon" which can lead to death but more frequently causes a considerable loss in body weight, due to the inability of the affected birds to walk normally. It will be noticed that the broiler diet has a higher level of manganese than the control ration. Normally, bran has four times the amount of manganese contained in wheat, consequently where a ration has a high proportion of grain as against mill offal, it is advisable to increase the level of supplementary manganese. Also in the case of high energy diets which have the effect of decreasing consumption it is usual to increase slightly the amount of minerals and vitamins normally included in a ration. For most present-day broiler diets it is recommended to include a level of 4 oz. of manganese sulphate per ton of feed.

Potassium chloride was present in the broiler rations as a possible preventive against the disease uraemia, which has increased in severity in this State recently. In New South Wales, uraemia is the major disease encountered in broiler flocks and many feeds contain potassium chloride.

In most hatches of cockerels reared at the Research Station over the last two years there have been slight losses from uraemia. Although the mortality has never been high due to treatment with antibiotics, some loss of weight is inevitable. Unfortunately the exact cause of uraemia is not known but it does seem as though potassium is involved. Further discussion of this topic will be found in the section dealing with the results of the experiment.

The inclusion of synthetic Vitamin A and D_3 is standard practice in nearly all broiler rations used in this State, and it should not be necessary to emphasise the importance of this. Unless an adequate supply of fresh, good quality green feed is provided for poultry, a deficiency of Vitamin A is almost inevitable and therefore it is good policy to ensure that a supplementary source of this vitamin is included in all rations.

Riboflavin is another vitamin of importance in poultry nutrition. In broilers a deficiency of this vitamin usually leads to poor growth and a condition known as "curled toe" paralysis, which is mainly evident in young stock. The quantity of synthetic riboflavin required in the ration depends upon the particular ingredients which make up the diet, as milk products, green feed and lucerne meal are relatively good sources of the vitamin. In the broiler ration under experiment, some riboflavin would be provided by both buttermilk powder and dried brewers' yeast but in order to ensure an adequate level of this vitamin, 200 mg. of synthetic riboflavin have been added. The riboflavin requirements of broilers is usually stated at 2 mg. per lb of feed.

Each year in this State one or two cases of pantothenic acid deficiency are recorded in poultry flocks. A deficiency of this vitamin in young chicks results in retarded growth in the early stages followed by the formation of scabby lesions on the margins of the eyelids, at the corners of the mandibles and around the vent.

Pantothenic acid deficiency occurs but rarely here and in view of the fact that Australian poultry rations usually contain a high proportion of wheaten by-products, which are claimed to be a good source of pantothenic acid, it may not be understood why this vitamin has been included in the broiler ration.

It should be realised however, that many rations may contain marginal levels of some of these micronutrients in which case the typical clinical symptoms may not be evident and yet the level for optimal growth may be inadequate. Also this broiler ration is based mainly on experimental diets formulated both in the Eastern States of Australia and overseas which have given outstanding weight gain figures, and as these rations commonly include pantothenic acid in the form of the calcium salt, despite the presence of several ingredients which are known to be rich in the vitamin, it was decided that the inclusion of this micronutrient was justified. The usual recommended level of

pantothenic acid in broiler feeds is 6 mg. per lb. of feed.

The remaining ingredient in the broiler ration was a preparation containing the antibiotic aureomycin. Much has been written about the effects of antibiotics on broilers and in some cases favourable responses have been obtained while in others they have not. In experiments conducted at the Research Station, one year, a significant response in weight gain was obtained while a similar experiment repeated two years later showed no advantage in including aureomycin in the feed as a growth-promoting substance. Although, under some conditions, aureomycin undoubtedly stimulates growth, particularly in young stock, the indiscriminate use of antibiotics, besides being expensive, is not recommended by veterinarians, as resistant strains of bacteria are then developed. If this occurs then the major function of antibiotics namely disease control, is seriously impaired.

Taking the rations as a whole the calculated fibre level of the control ration was 3.3 per cent. and that of the broiler diet 3.0 per cent. Both these values are satisfactory according to general standards.

Both the control and broiler rations were similar in calcium and phosphorus content. The control ration fed to six weeks of age contained 1.6 per cent. calcium (Ca) and 0.8 per cent. phosphorus (P) and the ration fed from seven to 16 weeks had 1.7 per cent. calcium and 0.85 per cent. phosphorus. The broiler diet consisted of 1.7 per cent. calcium and 0.9 per cent. phosphorus, both of these minerals being supplied mainly by the meatmeal and whalemeal fraction of the ration. No mineral supplement in the form of bonemeal, boneflour or rock phosphate was necessary in this ration as the increased animal protein foods provided adequate levels of calcium and phosphorus.

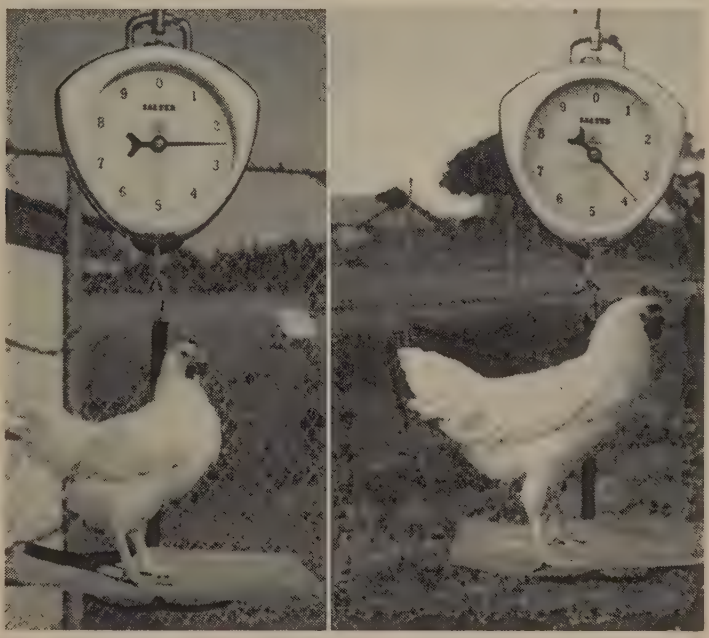

Fig. 3.—Two first-cross cockerels typical of the broilers used in this experiment. Both birds are from the modified broiler diet group. The bird on the left is 10 weeks of age and that on the right is 12 weeks old. These birds do not necessarily represent the average weights at their respective ages, but were picked at random from the group. From Table 6 it will be seen that the 10-week-old bird was slightly below the average weight of the group and the 12-week-old cockerel was above average weight

EXPERIMENTAL PROCEDURE

On April 28, 1959, 300 day-old first-cross cockerels were received from a local hatchery and divided into two equal groups by random selection. The birds were placed in 12 cage units with deep litter

floors and heat supplied by a hot water boiler. Each treatment was housed in six cages with 25 cockerels in each cage. Thus there were two treatments (designated as control and broiler) with 150 cockerels in in each treatment, and six replications of 25 birds within each treatment.

At the age of 31 days, the cockerels were transferred to 12 deep litter pens where they were held intensively under conditions approximating those existing on broiler farms, only on a smaller scale. Each bird was allowed 2 sq. ft. of floor space. Other features of management associated with all groups of broilers reared at the Research Station were debeaking the birds prior to shifting to their new quarters and toemarking in order to preserve the identity of each replication.

When the birds were 11 weeks old it was decided to reduce the number in each treatment to 40, which would constitute a representative sample of each ration, and these were housed in four pens, two on each treatment. The surplus cockerels were marketed and the remaining 80 broilers continued on until they reached 16 weeks of age when the experiment was concluded. Accurate records throughout the 16-week period were kept on mortality, feed consumption and gain in body weight.

RESULTS OF FIRST EXPERIMENT

Mortality.

Overall mortality of the total birds under experiment until the end of the trial was 5 per cent. Of the 15 deaths recorded from 300 birds, 8 were from the control group and 7 from the treatment on the broiler ration. This difference cannot be considered as significant. Remembering the particular conditions under which these birds were raised (as outlined in the section headed experimental procedure) it may be of interest to analyse the cause of death for the individual deaths. All post-mortems were conducted by qualified veterinary pathologists.

TABLE 2.
Details of Mortality.

Cause	Total	Control	Broiler
Accidental	1	1	....
Uraemia	2	2	....
Uraemia—Suspected	3	1	2
Intestinal Coccidiosis	1	1	....
Unknown—Diagnosis not possible due to week-end deaths	8	3	5
Total	15	8	7

The value of potassium chloride as a preventive against uraemia is not clearly indicated by the results in the above table as the incidence of the disease was only slight. If the outbreak of uraemia had been severe and confined to the control group then some conclusions on the worth of potassium chloride could have been derived. It can be argued that no positive case of uraemia was diagnosed from the broiler group but two suspected cases were recorded which exhibited clinical symptoms suggestive of the disease. In order to gain definite information on this subject a separate mortality trial would have to conducted, preferably by a veterinary pathologist. If uraemia continues to be troublesome in the industry there will be a need for this type of work.

It will be noticed that one case of coccidiosis was recorded. Unfortunately it was believed that the birds had little opportunity of contracting this disease during the brooding period because of the relative isolation and clean quarters, and for this reason a coccidiostat was not included in the diet until the birds were transferred to the rearing pens. Four days later one bird was affected but it is probable that the infecting organism was contracted before the inclusion of the coccidiostat. Immediate curative treatment was carried out over the whole flock and no further trouble was experienced. In subsequent batches a coccidiostat was fed well before the birds were transferred to their floor units.

Feed—Meat Conversion.

Body weight and feed consumption figures were obtained at frequent intervals throughout the experiment. The results obtained are most clearly presented in the form of a table as below.

TABLE 3.

Age in Weeks	Body Weight Average per Bird		Progressive Feed Consumption Average per Bird in lb.		Conversion Ratio	
	Control	Broiler	Control	Broiler	Control	Broiler
	lb. oz.	lb. oz.				
4	0 6·4	0 8·7	1·316	1·456	3·28	2·91
8	1 4·7	1 8·7	4·161	4·469	3·30	2·89
10	2 0·4	2 6·9	6·804	7·125	3·31	2·93
11	2 5·4	2 12·5	8·054	8·490	3·44	3·05
14	3 6·3	4 0·8	12·961	13·851	3·82	3·42
16	4 0·97	4 10·3	16·804	17·350	4·14	3·73

From these results it is evident that the broiler ration was superior to the control ration in respect to body weight gains and conversion ratio. Comparing the results for the two treatments, the average body weight of the broiler group was 19.0 per cent. higher than the control group at 11 weeks and 19.3 per cent. higher at 14 weeks of age. Besides the improved body weight the broiler birds were also more efficient in converting feed to meat as indicated by the conversion ratio which is calculated by dividing the progressive feed consumption by the body weight at a given age. At 11 weeks the broiler group had an 11.3 per cent. better ratio than the control birds and at 14 weeks they were 10.5 per cent. more efficient in conversion. For the above comparisons the ages of 11 and 14 weeks were selected as it is during the period between these ages that broilers are most profitably marketed.

The differences in body weight (and conversion ratio to a slightly lesser extent) in favour of the broiler treatment are highly significant in this trial. However, despite this rather spectacular result it is essential to convert the data into terms of expected profit before any claims for the ration can be made in respect to commercial application.

It should be appreciated that an accurate figure for profit is difficult to assess, particularly when relating to industry conditions as there will be considerable variation from farm to farm. We can however, calculate a fairly reliable estimate of expected profits under normal conditions. Where reference is made to the term profit in this article it is to be understood that this consists purely of income, derived from liveweight carcass value, over actual feed costs.

The variations in profit comparisons between the two treatments at the different ages would be only slight as both the body weight and conversion ratios differed by a reasonably constant amount throughout the trial. At 11 weeks the broiler group returned a profit of 3.60 shillings per bird whereas the control birds showed a profit of 3.74 shillings per bird. On this basis the control group returned a profit of 1.68 pence per bird greater than that obtained form the broiler treatment.

This result may be surprising, considering the greater efficiency of the broiler diet, but it must be remembered that the price disparity between the two rations was quite considerable. Therefore despite an increase of nearly 20 per cent. in body weight and 10 per cent. improvement in conversion, no financial gain was obtained from the broiler ration because of the fact that the diet was 43 per cent. more expensive than the control ration.

Fig. 4.—Broilers on this Wanneroo farm are brooded and reared on the floor in batches of 6,000 per house. Heat is supplied by a hot water unit with additional thermostatically-controlled infra-red globes to safeguard against breakdowns and temperature fluctuations. Note the abundance of feed and water containers

We can conclude from the results obtained in this trial that the newly formulated broiler ration was capable of supporting growth at a greater efficiency than that possible by the control ration but that the price disparity between the two diets was too great for the ration under test to be used commercially. However, the aim of the experiment was achieved and further work was carried out in order to formulate a ration of similar efficiency but cheaper in cost.

Before passing on to the second trial two aspects of the above experiment should be mentioned. Firstly the results clearly indicate that the broiler diet fed birds during the usual marketing period reach a set weight at some time between 1 and 2 weeks before the birds on the control ration. This enables the broiler grower to market his stock at maximum profit earlier than if the control diet was used and this constitutes an important saving particularly in labour. The other point was that there was very little range in weight in the birds on the broiler ration and this uniformity would influence the processors to pay top market prices whereas the more uneven control group may fetch lower prices per lb.

THE SECOND EXPERIMENT

FOLLOWING on from the first experiment a second trial was conducted testing a modified broiler ration somewhat similar to the broiler diet of the previous experiment except that the cost was reduced. The control ration used here was identical with the broiler ration of the first experiment. The reduction in cost was obtained by the omission of some of the micronutrients which were expensive and of doubtful value and it was desired to determine whether the modified broiler ration suffered in efficiency by the absence of these nutrients.

The two rations had the following composition:—

TABLE 4.

CONTROL RATION

(Broiler Ration of Expt. 1.)

Ingredient.	0-12 Weeks.
Wheatmeal	55 lb.
Ground Oats	5 lb.
Bran	9 lb.
Whalemeal	9 lb.
Meatmeal	9 lb.
Dried Buttermilk powder	5 lb.
Dried Brewers' Yeast	3 lb.
Fat	5 lb.
Salt	4 oz.
Manganese Sulphate	10 gm.
Potassium Chloride	1½ oz.
Vitamin A and D_3	34 gm.
Riboflavin	200 mg.
Aureomycin Preparation	2 oz.
Calcium Pantothenate	400 mg.

MODIFIED BROILER RATION

Ingredient.	0-12 Weeks.
Wheatmeal	55 lb.
Ground Oats	5 lb.
Bran	9 lb.
Whalemeal	9 lb.
Meatmeal	9 lb.
Dried Buttermilk powder	5 lb.
Dried Brewers' Yeast	3 lb.
Fat	5 lb.
Vitamin A and D_3	34 gm.
Salt	4 oz.
Manganese Sulphate	10 gm.

Both rations were identical in energy, protein, calcium and phosphorus levels as the omission of the micronutrients does not affect these. The price of the two rations was altered however, the broiler ration costing 5.72 pence per lb. and the modified broiler diet only 5.07 pence per lb.

EXPERIMENTAL PROCEDURE

The experimental procedure was identical with that of the previous trial with the exceptions that each replication consisted of 20 birds instead of 25 and the experiment was concluded when the birds were 12 weeks old. First cross day-old cockerels hatched on June 15th were used for the experiment.

RESULTS OF SECOND EXPERIMENT

Mortality.

Total mortality over the 240 birds on experiment was 6.7 per cent. for the 12 week period. The control treatment had a mortality of 5.0 per cent. while the modified broiler group had a mortality of 8.3 per cent. Details of the mortality are given in the following table.

TABLE 5.

Cause of Death	Number		
	Total	Control	Broiler (modified)
Omphalitis	1	....	1
Uraemia	8	4	4
Accidental	1	....	1
Leucosis	1	1	....
Unknown	5	1	4
Total	16	6	10

Body weight and feed consumption figures were obtained at 4, 8, 10 and 12 weeks and the results are shown in the following table.

TABLE 6.

Age in Weeks	Body Weight Average per Bird		Progressive Feed Consumption Average per Bird lbs.		Conversion Ratio	
	Control	Modified Broiler	Control	Modified Broiler	Control	Modified Broiler
	lb. oz.	lb. oz.				
4	0 10·34	0 10·21	1·55	1·49	2·40	2·34
8	1 12·9	1 12·5	5·24	5·22	2·90	2·93
10	2 10·1	2 9·1	8·06	7·99	3·07	3·11
12	3 6·2	3 6·1	11·14	11·10	3·29	3·29

These figures clearly indicate that there was no significant difference between the two rations, they were in fact, almost identical. At 12 weeks of age both groups average 3 lb. 6 oz. in body weight consumed 11 lb. of feed and had an identical conversion ratio of 3.29, a figure which is almost satisfactory for this age group and breed in this State.

When these figures are used to calculate expected profits we find that the birds raised on the cheaper modified broiler ration returned 7.2 pence per bird additional profit to that made by the group on the expensive control ration. This means that we now have a ration with the same potentialities for efficient feed to meat conversion as the broiler diet formulated in the first trial but which is reduced in price, and therefore becomes a commercial possibility. In the first trial the control group showed an extra profit of 1.7 pence per bird over the birds on the expensive ration and therefore by theoretical correlation the modified broiler diet would be expected to provide an additional profit of between 5 and 6 pence per bird above the anticipated profit which would be derived from feeding the normal ration used as a control in the first experiment.

THE THIRD EXPERIMENT

IN order to determine the value of the modified broiler diet in comparison with the normal ration used at present in the industry, a third trial was carried out with these two rations under test. The control ration was the same as that listed in Table I and the composition of the modified broiler ration was identical to that in Table IV.

There was no departure in the experimental procedure employed in the previous trials except that the birds were marketed at the age of ten weeks, by which time it was considered that the necessary information had been obtained. The experimental birds again consisted of 240 day-old first-cross cockerels which were hatched on August 4, 1959.

RESULTS OF THIRD EXPERIMENT

Mortality.

Up to the age of ten weeks there was a total mortality over the 240 cockerels on experiment of 6.25 per cent. Considering the two treatments separately it was found that the control group had a mortality of 7.5 per cent. while the birds on the modified broiler ration experienced a loss of 5.0 per cent. Details of the mortality are given in the following table.

TABLE 7.

Cause of Death	Number		
	Total	Control	Modified Broiler
Omphalitis	2	1	1
Uraemia	4	3	1
Accidental	1	....	1
Cannibalism	1	....	1
Unknown	7	5	2
Total	15	9	6

The one case of death by cannibalism occurred at the age of four weeks, just prior to transference to the rearing quarters at which time debeaking was usually carried out. Immediately this death was recorded the entire flock was debeaked and no further trouble was experienced from this complaint. It was unfortunate that seven deaths occurred during week-ends which prevented diagnosis by the pathologists.

TABLE 8.

Age in Weeks	Body Weight		Progressive Feed Consumption, lb.		Conversion Ratio	
	Control	Modified Broiler	Control	Modified Broiler	Control	Modified Broiler
	lb. oz.	lb. oz.				
4	0 7·63	0 8·99	1·43	1·52	3·00	2·71
6	0 13·89	0 15·79	2·62	2·93	3·02	2·97
8	1 5·5	1 8·7	4·52	4·79	3·36	3·10
10	1 15·2	2 3·8	6·83	7·06	3·50	3·16

Body weight and feed consumption figures were obtained at fortnightly intervals between four and ten weeks and the results, expressed as an average per bird, are presented in table 8.

This table further emphasises the superiority of the specially formulated modified broiler diet over the simpler control ration. At ten weeks of age there was a 14.7 per cent. difference in body weight and a 10.8 per cent. difference in conversion ratio in favour of the modified broiler group.

When estimated profit figures were calculated from these results it was found that the group on the modified broiler ration showed an extra profit of 1.6 pence per bird over the control group at the age of ten weeks.

THE FOURTH EXPERIMENT

THE previous trial demonstrated that apart from increasing body weight and improving the conversion ratio the modified broiler ration was also capable of returning an extra profit per bird in comparison with the control ration. This additional profit was obtained despite the relatively high price of 5.07 pence per lb. of feed. Obviously any reduction in the cost of the modified broiler diet which does not interfere with its efficiency will yield a greater profit.

One item of the modified broiler ration which, it was felt, could be reduced in price was the fat fraction. As mentioned earlier, high grade refined white mutton tallow was used in these experiments. This product would be available to the user at a price of 10d. per lb., which is relatively expensive, despite the fact that only a 5 per cent. level is included in the ration. Another fat product also available on the local market and usually referred to as mutton fat is procurable for approximately half the price of the white mutton tallow. This mutton fat consists of fat which is unrefined and is actually the same as the white mutton tallow except that it has not been rendered down and therefore contains small amounts of lean meat. This trial was designed to test the value of the cheaper unrefined fat against the high grade white mutton tallow. The main consideration was to determine whether the unrefined product could be used as a substitution for the high grade product without any detrimental effects.

It was important to determine whether the unrefined fat would show any rapid deterioration in quality and thereby become harmful to the birds and also whether the inclusion of some impurities adversely affected the feed to meat efficiency.

EXPERIMENTAL PROCEDURE

The trial consisted of 400 day-old first-cross cockerels with two replications of 100 birds on each treatment. Both treatments were fed identical rations except that one contained 5 per cent, refined fat and the other 5 per cent. unrefined fat. The composition of the rations was the same as that of the modified broiler diet listed in Table 4

It was found that the most satisfactory method of adding the fat to the mash was to melt the fat and then pour the liquid into the mash during mixing. In this way the fat was evenly distributed through the mash, each particle receiving a coating of fat. The melting of the fat presented no

difficulties in the case of the refined product which was simply placed in a metal container to which heat was applied and in a matter of minutes the solid fat melted into liquid. Relatively low temperatures are required as the melting point of the fat is not high. The unrefined fat usually required a longer period of heating and often left the residue which could not be melted down. When this unrefined fat was passed through a mincing machine before heat was applied, the procedure was as simple as in the case of the refined product.

For this reason it would seem necessary to pass the fat through a mincer before use in order to facilitate liquefaction. Mincing would slightly increase the cost of the product but the saving in time and the reduction in wastage from residues would justify this small rise in cost.

RESULTS OF FOURTH EXPERIMENT

Records were kept of mortality, feed consumption and body weight and these results clearly indicated that the unrefined fat was perfectly safe to use and also that this product was as efficient nutritionally as the refined fat.

Mortality was 10 per cent, to 12 weeks in the refined fat group and only 4 per cent. for the birds on the unrefined fat. This result certainly indicates that there was no danger associated with unrefined fat feeding. No special precautions were taken to prevent rancidity, in fact the fat was stored for periods up to three weeks under conditions commonly found in the industry. Every effort was made to keep flies away from the fat. The usual procedure was to procure fresh batches of fat at about ten day intervals and storage was at room temperatures. It was claimed that this type of mutton fat, although unrefined, was of a very stable nature and not prone to rancidity, under normal conditions. The low mortality obtained in the trial seems to verify this claim.

Body weight figures at the age of 12 weeks were slightly in favour of the unrefined fat group, the important point being that there was no significant difference in the efficiency of the two rations and therefore the unrefined fat may be used to replace the more expensive high grade white mutton tallow.

CONCLUSION

As a result of four broiler feeding trials a ration has been formulated which is capable of supporting considerably better growth at an improved conversion ratio when compared with normal rations at present used in the industry. Despite the relatively high price (approximately 5d. per lb) of this ration, a financial gain above that of normal rations was obtained. Special features of the newly-formulated ration include a significantly better body weight gain, which means that broilers reach market weight at an earlier age, improved efficiency as illustrated by the significantly better conversion ratios and greater uniformity in weight over the whole flock. The composition of this ration is given in Table 4 under the heading of modified broiler ration.

The expected extra profit made from birds fed on the new ration is not particularly high but it should be remembered that even a small profit per bird often becomes important when large numbers are involved, as is normally the case on broiler farms. Also two other factors associated with this ration represent possible further financial gain. These factors are the earlier age of marketing which represents a saving in labour, and also the uniformity in weights should influence the processors to pay top prices.

Further work in this field of broiler nutrition will be carried out during the coming season. The main object will be to further reduce the costs of the ration without a decrease in body weight or feed conversion. The fourth experiment discussed in this article has shown that a less expensive source of fat can be used with equally satisfactory results. This has slightly reduced the cost of the feed and at the same time slightly increased the profit. Other trials involving the replacement of a portion of the cereal content with alternative less expensive grain and a special finishing diet consisting largely of grain which would reduce the feed costs, have been planned for the next year's work.

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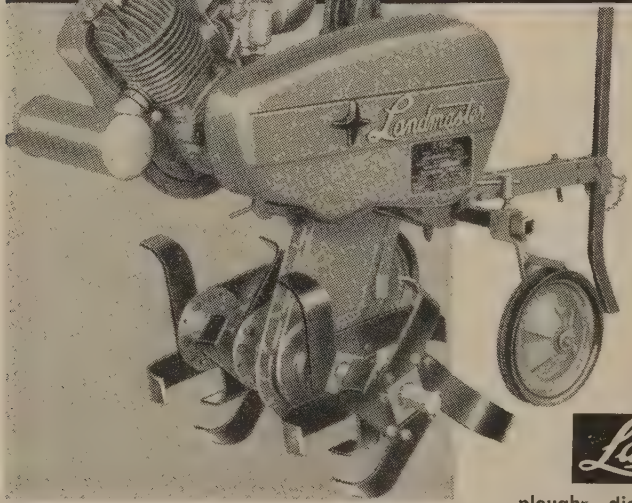

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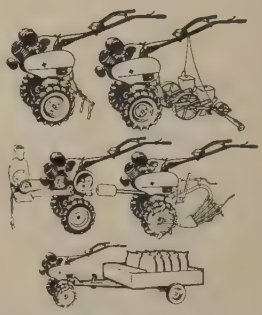

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● This Roller employing discarded truck tyres was made and used on the Denmark Research Station

A USEFUL FARM-MADE ROLLER

By V. WESTON, Manager, Denmark Research Station

A very serviceable compacting roller can be constructed at little expense by using discarded truck tyres. The roller described here has an overall width of 5 ft. 3 in. and carries seven 9.00 x 24 semi-trailer tyres which had been discarded when the treads were worn smooth.

Up to ten tyres could be used to give an effective width of 7 ft. 6 in. and for large areas rollers could be used in tandem or staggered formation.

The roller illustrated was designed for small farms with paddocks of only two or three acres in area. Wide rollers in such paddocks would be undesirable as they tend to drag when turning corners, resulting in uneven soil surfaces.

CONSTRUCTION

The first step is to make a wooden core to hold the tyres. Lengths of 4 in. x 2 in. jarrah are cut and checked out (half-jointed) to make three crosses as shown in the diagram.

The length of the arms of the crosses will be governed by the size of the tyres used. The 9.00 x 24 tyres give almost the ideal height, width and weight for the particular roller used on the Denmark Research Station. These tyres have an inside (bead to bead) diameter of approximately 24 in. so that the arms of the crosses are about 20 in. long to allow for the 2 in. thickness of the cross-stays, nailed or spiked to the ends of the arms. The core should be short enough to allow the inner surfaces of the tyres to press closely together when clamped.

Check tyre diameters carefully and make the core so that the tyres are a snug fit.

The next step is to make the metal end-clamps. These are also cross-shaped, made of any available flat iron or steel approximately 3 in. wide and ½ in. thick. Old dray or cart tyres are ideal for the end-clamps and for the frame reinforcements described later.

Lengths are welded in the shape of a cross and a hole is cut in the centre to take a stub axle 1½ in. in diameter and 14 in. long which is welded into position.

Fig. 1.—Front and back views of the roller showing frame construction

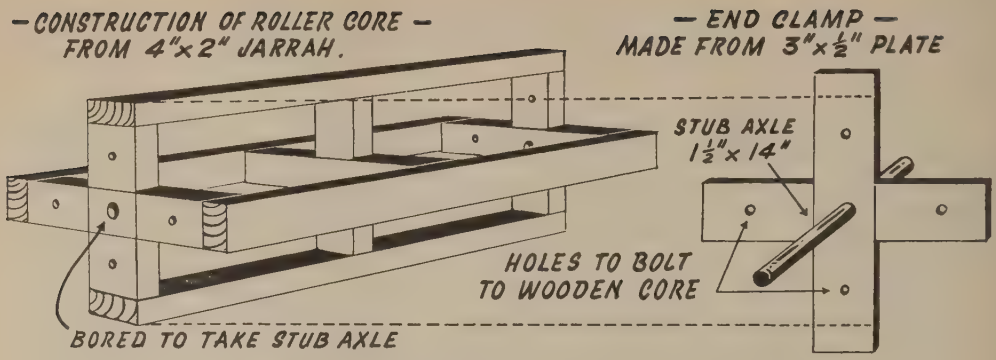

Fig. 2.—Diagrams showing construction of the core and the end-clamp

The stub axle projects 2 in. on the inside of the end-clamp, the centre of the wooden cross being bored out to take this projection. Holes are drilled in the end-clamps to coincide with similar holes in the wooden arms. Bolts through these holes hold the end-clamps and core firmly together.

The length of the arms of the end-clamps should be sufficient for them to project about four to five inches over the tyre walls.

ASSEMBLING

Bolt one end-clamp into position on the core, then stand the core on end with the end-clamp downward and force the tyres over the core. It will be found that the last tyre will project over the core and to fix the second end-clamp in position it will be necessary to use double-length bolts with long threads. Screwing down the nuts on these bolts will pull the end-clamp down into position and the projecting bolt-ends can then be cut off with a hacksaw or bolt-cutters.

THE MAIN FRAME

A simple rectangular frame is constructed from 5 in. x 3 in. hardwood securely braced with 3 in. x ½ in. metal at the corners. The drawbar is a 4 ft. length of 5 in. x 3 in. hardwood with a metal T-piece and angle-braces as shown in the photograph. The frame used in this roller

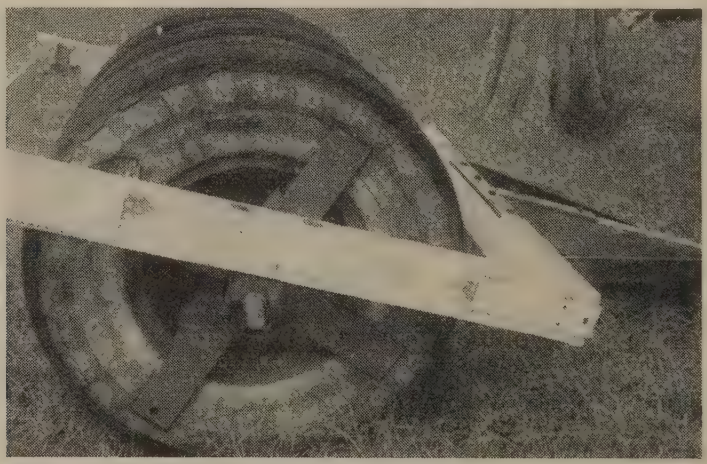

Fig. 3.—Side view showing end clamp, stub axle, and bearing

was fitted with brass-lined 1½ in. bearings but, where suitable metal bearings are not available, hardwood blocks will give good service.

This roller has been used successfully at the Denmark Research Station consolidating a seed bed after ploughing and cultivation. Excellent germination was achieved with spring-sown lucerne and early summer-sown Sudan grass. On the lighter sandy soils better results were obtained by rolling before and after seeding.

Contour Banks at Mingenew

How big is a contour bank? When new a contour bank is 18 to 21 inches high and this usually settles down to 9 to 12 inches. The bank is usually 6 to 8 feet wide at the base of the channel and the uphill side of the bank is a broad flat depression 8 to 15 feet wide. A contour bank can be any length to fit in with fence lines and natural depressions. Contour banks usually have a slight gradient increasing slightly towards the outlet end, gradients vary from level up to 4 inches in each 100 feet. Contour banks which help cure water erosion are usually 5 to 10 chains apart. Contour banks can be constructed by disc plough or road forming grader.

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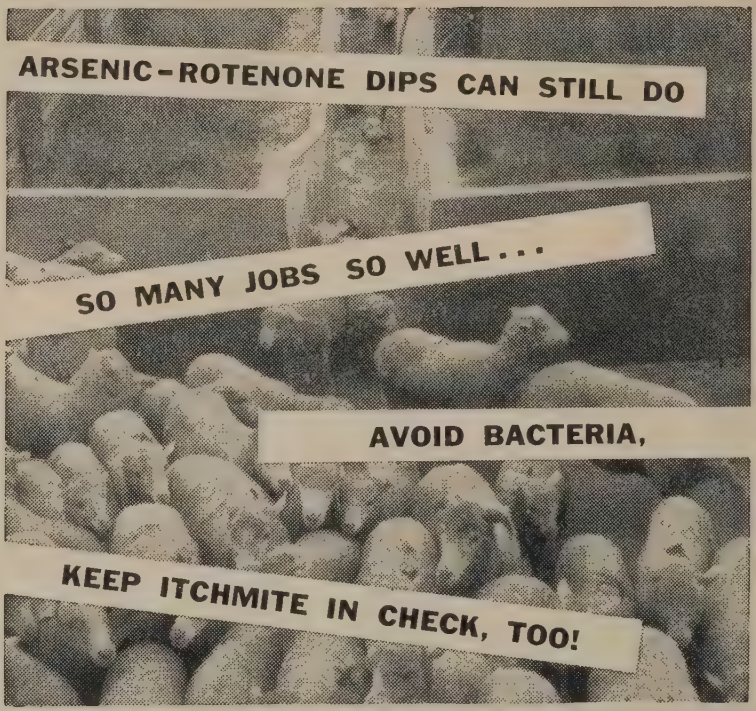

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RECORD KEEPING ON DAIRY FARMS

By R. A. BETTENAY, B.Sc. (Agric.), Adviser, Dairy Division

FARMING today is very much a business venture and the successful farmer is the one who is not only capable of doing the manual work, but who also has the ability to plan the work routine and determine which of the possible avenues is likely to bring the greatest financial return. For this, and many other reasons, simple but adequate records must be kept by all dairy farmers. Many types of records should be kept but if a routine is followed, a few moments' work each evening will suffice to keep things up to date.

Farm records can be divided into three types, namely those relating to farm and paddock history, those dealing with production records, and those dealing with the financial aspects and which are often kept by an accountant. Under farm and paddock history we can list the following:—

(1) Daily Dairy.

The daily diary is simply a day-by-day record of activities on the farm. In it you should mention such things as sales of stock, including number and price, cultivation or seeding of paddocks, and the work caried out on that particular day. The diary is a useful reference but by itself is not sufficient for many purposes and it is desirable to keep other records under particular headings where the information can be more readily obtained.

(2) Paddock Records.

Few farmers know the history of the various paddocks on their farms and all too many rely on memory as to what fertiliser has been applied or when a paddock was last cultivated or cut for hay. This position should be rectified by giving each paddock a name or number and keeping a card index system or loose-leaf notebook with one sheet per paddock, on which is kept a record of everything done to the paddock. In the front of the notebook you should keep a rough plan of the farm showing the paddocks. This would be useful not only for you but also for the purchaser if the farm changed hands.

The paddock sheet should contain such information as acreage and when cleared and as full a history as possible of such things as fertiliser used, when cut for hay or silage, when cropped and so on. This information is essential if you are to determine what treatment should be applied from year to year and would be most helpful to an Adviser called in to determine deficiencies, etc., which might have appeared over the years.

(3) Fertility and Mating Records.

Over the last few years it has become evident that vibriosis is very widespread throughout the dairying areas and it is important to keep very complete records of heat periods and mating days of all cows, whether you are using natural mating or are a member of the Artificial Insemination Scheme. The best place to keep such records is in the dairy, and shed charts are available to members of some of the A.I. sub-centres and are to be made available at other centres. One chart is sufficient for about 30 cows with one line per cow, and there is provision for recording all heat periods and mating days. From these charts you can readily see when to watch for a cow coming on heat and whether she should be mated, keeping in mind that it is desirable not to mate before the third heat period after calving. The information supplied by a shed chart is also very necessary if you have infertility, as it will give a visiting veterinarian a lead as to what diseases may be present in the herd.

Many farmers find it useful to have a blackboard in the dairy for making notes of things which change from day to day. On these you should record such things as which cows are to be mated when on heat and where bail feeding varies with production, the amount each cow is to receive.

PRODUCTION RECORDS

(1) Herd Recording Day Sheets and Annual Summary.

No records on a dairy farm can be complete without production records of the individual cows and these are available only through Herd Recording. It has been amply demonstrated many times that, without these records, culling for production cannot be effectively carried out as it is impossible to select the low producers on appearance.

Members of the Herd Recording Units are visited once each month during the lactation period and are left with a Day Sheet showing the production of each cow on the day of test together with an estimated 30-day yield and a progressive total for the lactation. At the end of the season an annual summary is sent out showing production of all cows which completed test in the previous 12 months. This summary can be used as a basis for culling according to production but if the herd has been under test for longer than one year it is better to cull on the basis of lifetime production and for this reason the Department has devised a Cow Record Card which is available to all farmers for a small fee.

(2) Cow Record Cards.

These are available in a loose-leaf folder, the cost being 7s. 6d. for the folder and 3d. per card. One card is sufficient for the lifetime production of a cow and there is provision for such information as date of birth, etc., of the cow and tattoo number of any of her progeny so that promising cow families can be selected and concentrated upon in the breeding programme. The sheet has provision for up to ten lactations so that one sheet should be sufficient for almost any cow. Lifetime production is a much more useful basis for culling than the results of any single lactation and all records, good or bad, should be considered when you are deciding which cows are not paying their way and would be better replaced by heifers as these become available.

(3) Annual Herd Production Records.

It is surprising how few farmers can easily turn up figures showing the annual butterfat production records of the farm and it is most desirable that these be kept in a readily accessible form. Over the years these give an idea of progress being made on the farm. If this figure is available it can be used to determine butterfat production per cow and per acre and these can be compared to the results achieved by other farmers to give an idea as to where improvement can best be made.

FINANCIAL RECORDS

(1) Cash Book.

The cash book should contain details of all financial transactions as they occur and should be in two parts with expenses and income in separate sections. It is recommended that separate columns should be kept for the various classes of expense and receipt (Tables 1 and 2) and each item should occur twice, once in the totals column and once itemised in its appropriate colum.

Items of personal and household expenditure should not be omitted but need not be shown in detail, if a monthly cheque is presented to the bank to cover anticipated routine household expenses.

Both expense and income statements should be entered regularly as the money is paid into the bank or a cheque is made out to pay the bill. The amounts should be totalled at regular intervals—perhaps every month.

Where farmers buy goods from, and sell produce to, the one firm, a monthly statement is usually received itemising the various transactions but the actual cash payment covers only the excess of one over the other. However, the individual items should be transferred in detail to the cash book to give a complete picture of income and expenses from the various items.

The cash book will naturally cover the financial year and will "start from scratch" as at 1st July each year.

(2) The Farm Inventory.

At the end of the financial year a farm inventory should be made as this is necessary before the net income from the farm

Table 1

FARM EXPENSES

For Year ended 30th June, 1960

Date	Expenditure Details	Total Business and Private	Household and Personal	Purchased Livestock	Fodder Seed and Fertiliser	Rents, Rates, Insurance, Interest	Repairs and Replacements	Petrol, and Oil, etc.	Cartage Wages	Capital Improvements	Other
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Brought Forward		792 19 7	320 11 4	19 2 6	130 2 0	31 6 2	19 1 4	45 6 11	17 6 0	200 0 0	10 2 7
Oct. 2	20 Bush. Seed Oats	15 0 0	....	....	15 0 0	....	....	....	....	....	....
Oct. 9	Vet. Exp.	6 10 0	....	....	....	....	....	....	....	....	6 10 0
Oct. 16	Tractor Parts	11 4 6	....	....	....	....	11 4 6	....	....	....	....
	Three drms. kero	20 6 3	....	....	....	....	....	20 6 3	....	....	....
Oct. 23	Cream Cartage	5 1 6	....	....	....	....	....	....	5 1 6	....	....
Oct. 30	Housekeeping	65 0 0	65 0 0	....	....	....	....	....	....	....	....
	Bran, 6 bags	7 10 0	....	....	7 10 0	....	....	....	....	....	....
	Life Assurance	35 7 0	35 7 0	....	....	....	....	....	....	....	....
Oct. 31	Electricity	17 5 8	17 5 8	....	....	....	....	....	....	....	10 0 0
Total to end of October		976 4 6	428 4 0	19 2 6	152 12 9	31 6 2	30 5 10	65 13 2	22 7 6	200 0 0	26 12 7

Table 2

FARM INCOME

For Year ended 30th June, 1960

Date	Income Details	Total Income	Butterfat	Cattle	Pigs	Sheep & Wool	Other
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Brought Forward	....	995 0 0	637 10 0	125 0 0	180 10 0	52 0 0	....
October 10	Sept. B/fat 1,070 lb. @ 4/3	227 7 6	227 7 6	....	....	....	....
October 16	Two Cull cows	96 0 0	....	96 0 0	....	....	....
October 23	Four Baconers	71 10 0	....	....	71 10 0	....	....
Total to end of October		1,389 17 6	864 17 6	221 0 0	252 0 0	52 0 0	....

can be calculated. This is usually carried out with the aid of an accountant but farmers who are prepared and understand the methods of depreciating machinery, fencing, etc., could do this if they so desired.

Briefly the inventory includes firstly taking stock of everything on the farm at the end of the financial year and an exercise book can be used for this purpose with all items listed in the same order as the previous year to facilitate checking against the previous list. Items which should be listed include livestock, machinery and equipment, buildings, fences, water points, fodders and other supplies on hand.

Secondly it is necessary to place a value on all of these items which may be the actual cost price, or where items not purchased are concerned, maybe the market value or value to the property. Items which depreciate are then written down in succeeding years until they are sold or until the book value is reduced to nil. When items are sold, unless the sale price is the same as the book value, a cash adjustment must be made.

(3) Income Statement.

Once the farm and livestock inventories have been brought up to date it is possible to set out an income statement for the year. The net income from the farm will be the difference between total receipts and total expenses after allowance has been made for depreciation of plant and machinery and changes in stock numbers and value. It therefore represents the return to the farmer for his labour, management and capital investment plus any family labour used and not shown as a cash cost.

USING THE RECORDS

If the records listed above are kept, and understood, the farmer is in a strong position to review his farming activities to determine which of his ventures were the more profitable and which did not pay and should be either made more efficient or eliminated. Where the cash records are kept by an accountant it is important that the farmer should be fully conversant with the various items of income and expense so that he can make the right managerial decisions as to what activities should be concentrated upon to increase the farm income.

One of the major activities of Group Farm Advisers where they have been appointed has been to go thoroughly into the various items of farm income and expenses to determine where savings can be made by comparing the results on the one farm with the average of a large group of neighbouring farmers in the same line of business.

With its present staff the Agricultural Department is not in a position to assist all farmers in this way but a look at the Income and Expense Statement will often suggest to the Adviser where improvements can be made and savings effected.

A DURABLE LIMEWASH

A paint made from slaked lime, cement and skim milk makes a durable covering for farm buildings.

Fill a drum to a third of its capacity with unslaked lime and add water in small quantities to slake the lime thoroughly. Cover with a bag and let stand overnight, then take some of the lime putty and add to it about an equal bulk of cement, mixing the two thoroughly.

Thin down with skim milk and run through a sieve to take out any coarse stuff which may remain. Colouring matter to produce any desired shade may be dissolved in a small quantity of water and added to the mixture together with two handfuls of salt.

Where skim milk is unobtainable, tallow is added to the lime during the slaking process in which a large amount of heat is generated. The tallow is added in the proportion of 1 to 2 lb. of tallow to 7 lb. of lump lime.

In all washes containing cement, the mixture must be kept stirred while being applied as the cement tends to precipitate.

BLUEBUSH SEED SUPPLIES

By C. V. MALCOLM, B.Sc. (Agric.), Soils Division

A GREAT deal of publicity has been given of late to the value of bluebush *(Kochia brevifolia)* as a plant for some types of salt-affected land, particularly in the drier parts of the wheatbelt. Obtaining seed supplies can be a problem, but fortunately large amounts of seed are not required since once a few bushes are established they will spread seed over the intervening areas. Thus rates of 1 to 2 lb of seed per acre have been found quite satisfactory.

At present, the only suppliers of the seed in commercial quantities are Elder, Smith and Co. Ltd., Perth. However bluebush is very widespread in our wheatbelt and it is likely that for any property on which there are suitable areas for bluebush establishment there is a bluebush occurrence within 20 miles. This may not apply in the North-Eastern Wheatbelt districts. Some good areas are at Carnamah, Buntine, Dalwallinu, Quairading, Bruce Rock, Narembeen, Kulin (east) and Lake Grace. In some cases, bluebush has overrun vacant land in country towns, as at Bruce Rock. In other areas it forms stands in road and rail reserves and in small unused paddocks. The harvesting by hand of sufficient seed to start bluebush in a salty area is quite simple.

The bushes may produce seed any time between November and July, but production is most prolific about February-March. Flowering and seed-ripening is a continuous process. Thus at any one time there may be young flower buds blooming flowers and ripe seeds in large numbers on the one bush. In collecting seed it is best to use a super bag with a wire hoop sewn into the mouth to hold it open. The bag is held in one hand and with the other branches are pushed inside the bag and shaken vigorously to dislodge all seed. It is possible under good conditions to collect 3 lb. of seed in an hour. Bushes with light crops of seed give much lower yields. It is well worth while to spend some time in finding the most heavily-laden bushes and harvest from these.

The shaking process results in a seed sample which contains, apart from hundreds of insects, large numbers of fleshy green leaves and a fair proportion of unripe seed. Adequate opportunity for drying is essential if this seed is to be of any use. Drying can be achieved by spreading the seed in a layer one to two inches thick away from strong wind and moisture. When the material is thoroughly dry it may be bagged and stored in a dry place. What appear to be open pink flowers in the original sample will on drying ripen to give good viable seeds.

Seed cannot be stored under normal conditions for more than a few months. It must therefore be sown in the year in which it is collected.

The germination of a good sample should be about 90 per cent. though in establishment on salt land it is not likely that more than 30 per cent. of seed sown produces plants, and in most cases very much lower counts results. Trials are in progress aimed at raising these figures and eliminating some establishment hazards.

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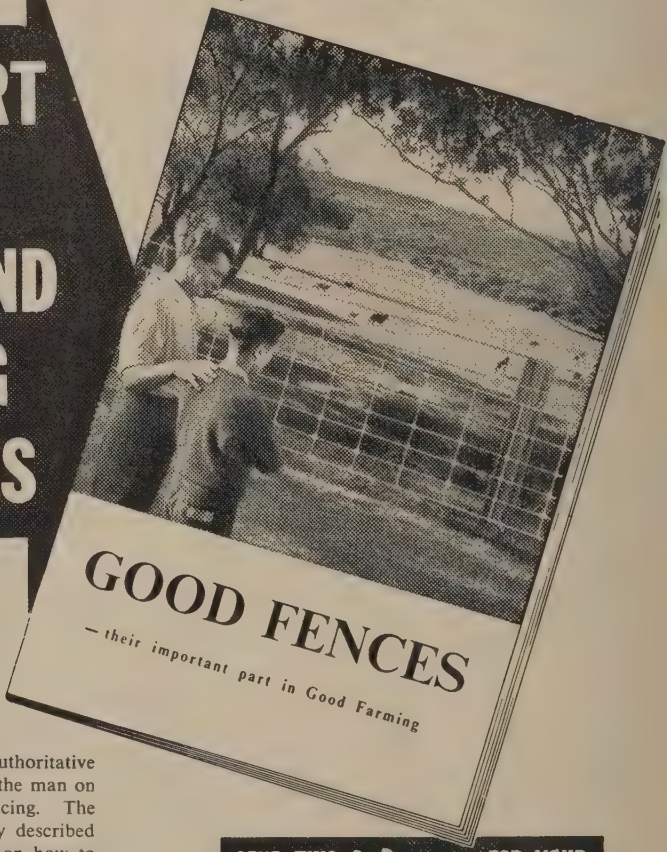

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SPARK ARRESTER TESTS

TEST No. SPA–8, YUBA MODEL, JUNE, 1958

SPARK ARRESTER FOR FORDSON DEXTA

TESTED FOR FORD MOTOR Co. OF AUSTRALIA PTY. LTD.

FORMAL tests on spark arresters are conducted by The Tractor Testing Committee* at the Testing Station, Werribee, on behalf of those Companies concerned with tractors, engines or spark arresters who wish to have these equipments tested. The arrester is tested on the engine for which it is especially designed or if this is not convenient, it is tested on an engine having the characteristics and power for which the spark arrester is intended.

1. Test Procedure.

The method of test is based on a procedure standardised by the Society of Automotive Engineers (U.S.A.); this consists of feeding a weighed quantity of carbon particles of given size into the exhaust of the working engine, and then catching in a trap, and weighing, the particles that the arrester allows to pass through. Separate runs are conducted with particles of larger and smaller size; in some runs the engine is working at full load, in others at fast idle under no load.

According to the S.A.E. standard, no particles of the larger size should escape the arrester, and not more than 10 per cent. of the smaller size. At the same time the extra back pressure imposed on the exhaust system by the presence of the arrester should be no more than 10 inches in a water barometer.

2. Name and Type of Arrester:

Fordson Dexta.

Submitted by: Ford Motor Co. of Australia Pty. Ltd., Geelong, Victoria.

For Particular Engine:—Fordson Dexta Tractor.

3. Brief Specification of Arrester.

Operating Principle:—Centrifugal separator.

Declared Max. Horse-power:—Not stated.

*The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders-lane, Melbourne.

Dimensions:—Exhaust pipe, diameter 2¼ inches; Tail pipe, diameter 2½ inches, length 12 inches; Arrester, outside diameter 5½ inches, length 25 inches, weight 10 lb.

Materials:—Body—16 g. steel; Swirling Vanes—C.I.

Mounting:—Vertical, ahead of operator, effluent upwards.

Details of Test Engine:—Fordson Dexta Tractor. 30 belt HP Max., 44 cu. ins.; rated speed—2,200 r.p.m.

4. Summary of Test Results.

(*a*) *Effectiveness of Spark Arresting:*—See Note below.

Particles Injected at Rate of 100 Gms. in 18 to 20 Mins.

Particle Size	Engine Load Condition	Carbon Passing Arrester (Percentage)	Remarks
Large	High	Less than 0·1*	Two tests
Large	Low	Nil	Two tests
Small	High	2·2	Average of two tests
Small	Low	Less than 0·1*	Two tests

* 0·1 gm. being the limit of accuracy of the scales.

(*b*) *Back Pressure:*—At high load 5.5 inches water. Steady throughout tests.

(*c*) *Temperatures* (°F):—Outer casing 770°F approximately.

(*d*) *Noise Levels:*—Not taken.

Note.—This report makes no promise about the likely performance of this spark arrester other than in the *new* condition for which it was supplied for test.

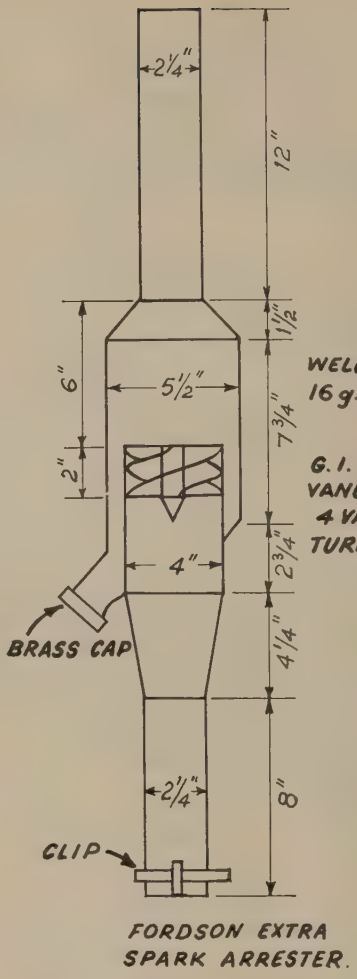
5. Comments.

Life:—From inspection of a cut-away sample it appears likely that the arrester would have a minimum life in accordance with the S.A.E. requirements, i.e., equal to the life of the engine. The parts most subject to heat are of adequate size and securely fixed.

Cleaning:—The arrester is intended to be cleaned by removing the brass cap; continued tapping of the body of the arrester is necessary to cause the contents to run out. The arrester may however be blown out, provided conditions for doing so are safe, by removing the cleaning cap and blocking the outlet pipe for a few seconds, while the engine is running.

W. F. BAILLIE, Testing Officer.
G. H. VASEY, Officer in Charge, Tractor Testing.

University of Melbourne, 12th June, 1958.



BEEF GROWTH RATE STUDIES

Report on the Pardelup Prison Farm Trials

Acknowledgment of assistance by the Officer-in-Charge and staff of the Pardelup Prison Farm was inadvertently omitted from the report published in this Journal for November-December 1959. It is desired to record appreciation of the excellent assistance given by all who were associated with this trial and also to officers of the Department who were responsible for recording the weights and preparing the monthly reports.

Fruit Fly

By D. G. SHEDLEY, Entomologist

FRUIT fly control is compulsory! To obtain effective control of fruit fly it is necessary to combine strict orchard hygiene with bait spraying. In addition, cover spraying with DIPTEREX will give extra protection to stone fruit and pears. When the breeding powers of the fruit fly are considered it is easy to understand why home growers and orchardists need to fight a continual battle against this pest.

During May 1959, more than 150 flies developed from one pear and 80-100 flies from several other individual fruits held in the laboratory. The possible danger of leaving one or two fruits on a tree may well be seen from this. A few dropped fruit hidden in the grass or under leaves below the tree may result in a heavy attack on later fruit. Thus the importance of keeping the trees so that all fruit can be picked and removed from the ground without delay may be understood.

Treatment of the soil with various chemicals will kill some of the maggots as they enter the ground. However, the only safe way of disposing of infested fruit is by boiling, burning or holding under water and kerosene for three to four days.

Many insecticides and methods of applying them have, over the past years, been tested against fruit fly. Malathion mixed with white sugar has given good control splashed or sprayed onto the leaves of the fruit trees. The flies feeding on the poison mixture soon die.

Scientists, while endeavouring to keep fruit flies alive and breeding for experiments, discovered recently that there are certain materials which are necessary for proper development. Resulting from the breakdown of the protein in yeast and some other substances they have become known as protein hydrolysates or hydrolysed proteins. The protein hydrolysate of yeast, soy bean meal, and some otherwise waste animal products have all been found to supply this need for the fruit fly. The flies, apparently being aware of their dietary need are attracted and may be killed by the addition of a poison such as malathion.

Dipterex is very effective against fruit fly, for besides being toxic to the adult flies it penetrates the fruit and kills the eggs and maggots inside.

Fruit which has been struck, recently, before there has been time for development, can be saved by spraying with Dipterex. It is important to make the spray a thorough one. One spray two weeks before harvest and one ten days later is usually sufficient for early stone fruit. Later-maturing fruit mostly needs at least one earlier spraying. Dipterex should not be used to replace, but to augment, orchard hygiene and baiting.

New insecticides such as Rogor 40 and and "Lebaycid" have been developed in recent years and are very promising against fruit flies at all stages: eggs, larvae and adult flies. Local tests with

these and other insecticides are being continued in an endeavour to find the most efficient and reliable control measure.

To conclude, the main points to observe are:—

(1) Keep trees to a manageable size.
(2) Pick fruit as it matures.
(3) Pick up all fallen fruit.
(4) Properly destroy all suspects.
(5) At regular intervals splash on to leaves a bait as recommended on the back of your orchard registration receipt and in the Departmental leaflet which you can obtain on request.
(6) If necessary thoroughly spray stone fruit and pears with Dipterex.

Points in Purchasing Seed

By B. J. QUINLIVAN, Advisor, Seed Certification and Weeds Branch

AT this time of the year many farmers will be giving some thought to their pasture and crop seed requirements for the coming season, and a few words on some of the basic aspects of seed quality would not be amiss.

The three points to be considered when purchasing seed are purity, germination, and strain. Purity involves not only the proportion of impurities such as straw, broken seeds, and soil particles which may be present in any line of seed, but also covers the very important aspect of weed seeds. Without doubt the commonest method of spreading weeds is by way of agricultural seed. Badly graded lines of wheat, oats or barley almost invariably contain a fair proportion of wild turnip, wild radish or mustard and may even contain more serious weed seeds such as saffron thistle. Subterranean clover seed which has not been graded, frequently contains Guildford grass, corkscrew and dock seed in quite appreciable quantities. Cape tulip bulbs and saffron thistle seed have also been found in low grade subterranean clover seed on a few occasions.

The second factor which must be considered when purchasing seed is its germination. Seed which has a low germination is of little value to anyone and while low germination is not common in cereals it is still a very important factor in pasture seed. A low germination in legume pasture seeds can be due to the presence of a high proportion of dead seeds or hard seeds. The presence of dead seeds is more often than not due to faulty harvesting techniques and normally cannot be detected by a visual inspection of the seed. The presence of a high proportion of hard seeds is the result of insufficient scarification. Hard seeds must be conceded to have some value in that they will eventually germinate but this may not take place until several years after sowing.

The third factor to be considered is the question of strain. In some instances, strain differences can be detected from the seed itself but in a large number of cases this is not so and the only sure way to obtain the strain which you require is to purchase certified or pedigreed seed.

The most widely sold pasture seed in this State is undoubtedly subterranean clover, and eight different strains of this species are available as certified seed. If a farmer buys certified seed he is guaranteed that the seed has a minimum pure seed content of 98 per cent. and a minimum germination of 80 per cent. He is also sure that he will obtain the strain he requires. The purchase of uncertified seed—particularly seed which has not been graded—is a very risky proposition. More often than not such seed has a pure seed content of 80 to 85 per cent. and a germination of 45 to 50 per cent. Its value for pasture establishment is therefore less than half that of certified seed. In addition, such seed is also sure to contain a good proportion of lucerne flea, red mite, spear grass, corkscrew, dock and Guildford grass. It may also contain more serious weed seeds such as saffron thistle and Cape tulip. These factors combined with the lack of any guarantee as regards strain makes the purchase of such seed most inadvisable.

Some lines of uncertified seed, of course, are quite satisfactory. If the buyer is not particularly concerned about the strain, provided he purchases a well graded line of seed he will more often than not get satisfactory results but generally speaking the best buy is certified seed, even though the price may be slightly higher.

CAN SPRAYING FOR WILD RADISH AND TURNIP AFFECT THE CEREAL CROP

By G. R. W. MEADLY,
Officer in Charge, Weeds and Seeds Branch

THE hormone-like herbicides are playing such an important part in the control of weeds in cereal crops, that there is a tendency to accept them as being completely selective with a capacity to remove the weeds without any risk to the crop. This is particularly the case when dealing with wild radish and wild turnip which are among the more susceptible weeds and require relatively small doses.

Large-scale spraying in Western Australia has now been carried out for almost ten years and quite early in this period, as a result of research, it was possible to indicate the growth stages of cereals at which they were most likely to be affected by the application of 2,4-D and related chemicals. There are two periods during which the risk is greatest. The first is in the seedling stage and continues until the plants are stooling freely. The second is at the "boot" stage when the head becomes apparent as a swelling in the leaf sheath. The hazard remains during the flowering period but again decreases when the grain has reached the milk or soft dough stage. This means that spraying should be carried out after the cereal is stooling freely but before the head has obviously commenced to form.

It is interesting to note that the nature of the effects on cereals may differ according to the time they are caused. Treatment during the early danger period can result in a number of malformations and growth disturbances. Wheat may produce club-shaped, twisted and branched ears with an irregular arrangement of spikelets. The glumes may become fused and the number of spikelets reduced, resulting in interrupted heads. Leaves also become twisted and often there is some delay in maturity of the crop. Late spraying does not usually cause abnormalities but has brought about a reduction in grain formation.

During the past season there have been an increased number of reports from farmers of effects on cereals attributed to spraying for weed control. This could be due, in part, to the greater interest being taken by farmers in such activities but there would also appear to be other causes. In the main, the symptoms are those associated with spraying too early and in a number of cases inquiries have confirmed that such has applied. Abnormal heads have also been found in crops sprayed at the recommended growth stage but they have represented only a small proportion of the total crop.

The most frequent symptom has been an irregular disposition of the spikelets as opposed to the normal series of rows. Many are obtusely angled from the stem or rhachis and the term "scatter-heads" has been applied to them. At times, gaps have appeared in the spikelets giving rise to interrupted heads and various forms of twisting have occured in the stems, leaves and heads.

Abnormalities have been associated with application by ground units as well as aircraft and one half gallon of solution per acre does not appear to have been more critical than one gallon when applied from the air.

Symptoms of frost damage are very similar to some manifestations of 2,4-D injury. It is known that reaction to 2,4-D is influenced by various factors including soil moisture, temperature, fertilisers and soil type, and it is quite possible that frosts, besides causing direct injury have, at times, accentuated the effects of 2,4-D.

Despite the more numerous reports of crop injury during the past season, investigations carried out by the Department indicate that a significant reduction in yield is only likely in relatively few instances and then only when crops were

sprayed too early. In most of such cases farmers agreed that if the crop had not been sprayed, the competition from weeds would have reduced yields to a greater extent. Research into this aspect is being undertaken by the Department, but the hormone-like chemicals undoubtedly will continue to play an important role in cereal husbandry in Western Australia.

Improving Wheat Quality

By J. PARRISH, Cereal Products Officer

THE large surplus of grain stored in North America has drawn attention to the world wheat market and Australian producers have been faced with the prospect of a much larger carryover. For many years now Australian wheat has been in demand on the world market and has enjoyed a good reputation for dryness, colour and high milling yield.

Recently there has been considerable criticism of the quality of Australian wheat, at least within Australia if not abroad. The main target for criticism has been the mixed nature of F.A.Q. wheat, and critics have suggested it should be separated into hard and soft grades.

There are many different opinions on this aspect of wheat marketing but it is generally agreed that there is a need to improve the over-all quality of the wheat harvest.

The main factors determining quality in wheat are breeding (that is the variety grown) and environment (or conditions under which the crop is grown).

In Australia, plant-breeders have had notable success in producing better quality varieties.

The variety Gabo which is grown on about one-third of the State's wheat acreage is an outstanding example of a good quality variety produced in Australia.

The Cereal Laboratory of the Department of Agriculture has a big part to play in the improvement of quality by means of breeding. Each year, thousands of grain samples each coming from a single plant cross-bred are examined for quality in the Cereal Laboratory by a wheatmeal fermentation test called the Pelshenke test. Results of these tests enable the wheat breeder to discard much material of inferior quality at an early stage in his programme.

When there is sufficient grain from a new variety it is milled, and the flour is examined for baking quality in the Laboratory. Until this year the main way of determining baking quality has been by using a farinograph to measure some of the physical properties of a flour-water dough.

Recently the new Laboratories at South Perth have been equipped to carry out baking tests and it will now be possible to bake sample loaves from any variety, before it is released for commercial production.

The second important factor affecting quality is environment, or the growing conditions for any particular season.

Climate and soil are the main aspects of environment. A short-season climate with a short time of ripening is favourable to high quality and a longer season where the grain has more time to ripen favours yield at the expense of quality.

There is little that man can do to control the effect of climate except to grow suitable varieties in various climatic regions.

Soil also has a big effect on quality and here there is much that man can do to control the effect of soil. Lack of soil fertility is the main reason why this State does not grow large amounts of high quality wheat.

This low inherent fertility of our soils can be overcome either by the use of nitrogenous fertilisers or of leguminous rotations.

Although application of nitrogenous fertilisers is an effective means of improving quality, in most cases it would not be economic at present.

It has been well established that the inclusion of a legume in the rotation improves both the yield and quality of wheat grain. This is a simple and practical method of improving quality for wheat growers in areas where subclover can be grown.